

*ERRS Region 2*

Westwood Chemical Corp. Quality Assurance Sampling  
and Analysis Plan

Revision: 0

April 8, 2005

# Quality Assurance Sampling and Analysis Plan

*Site:*

Westwood Chemical Corporation  
46 Tower Road  
Middletown, NY 19041

*Submitted to:*

Mr. Dilshad Perera  
46 Tower Road  
Middletown, NY 19041

*Prepared for:*

USEPA  
2890 Woodbridge Avenue  
MS-211  
Edison, NJ 08837

*Prepared by:*

Earth Tech, Inc.  
7870 Villa Park Drive, Suite 400  
Richmond, Virginia 23228

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Westwood Chemical Corp. Quality Assurance Sampling and Analysis Plan  
Revision: 0  
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This document has been reviewed for technical content and quality, clarity, and style in accordance with the internal QA/QC procedures of Earth Tech.

### Technical Review:

April 8, 2005  
Date

Date \_\_\_\_\_

Date \_\_\_\_\_

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### **Distribution List**

Mr. Dilshad Perera, USEPA, OSC  
Dave Bofinger, Earth Tech, Project Manager  
Ken Bracken, Earth Tech., T&D Coordinator  
Mark Kromis, Earth Tech, QA Manager

**1.0 SITE BACKGROUND**

Westwood Chemical Corporation specialized in developing, manufacturing, and marketing aluminum and zirconium based active ingredients for the cosmetic, toiletry, and water treatment industries. Westwood Chemical produced two major products while in operation, prior to their shutdown. The first, which generated approximately 85-90% of their revenue, was making aluminum-zirconium salts as the active ingredient in antiperspirants. Their second product, which accounted for the remaining 10-15% of the revenue, was an aluminum salt solution which was used in waste water as a flocculant. Both processes began with reacting aluminum ingots with hydrochloric acid (20 degree baume) and water to produce an aluminum chlorohydrate solution. Once they had the aluminum chlorohydrate, it could be mixed with zirconium oxychloride (ZOC) and/or zirconium basic carbonate (ZBC) to produce the aluminum zirconium trichlorohydrate for antiperspirant. Or the aluminum chlorohydrate could be further reacted with sulfuric acid to produce the polyaluminum hydroxychlorosulfate, which was sold as the water treatment flocculant. In addition, sometimes they would mix polyquaternary amine or poly dimethyldiallylammonium chloride into the water treatment product.

The majority of the material for disposal at the site, approximately 160,000 plus gallons, is a wash/rinse water that they generated during production. The material is stored in bulk tanks, totes and drums. Some of this material has the potential to be hazardous for chromium and lead, as well as being corrosive, but the majority is believed to be non hazardous. The work plan calls for bulking the totes into empty storage tanks, and sampling from there. The site also contains bulk tanks of muriatic acid which will need to be sampled, as well as bulk tanks of unused aluminum chlorohydrate solutions.

The site contains three R&D and QC laboratories, and their contents will need to be lab packed for disposal. Also, the basement has a storage room that is full of small QC samples of both finished products and raw materials. The initial plan for this material is to haz-cat for compatibility, and then bulk the small containers into drums for disposal. The warehouse contains drums of both finished and raw product that will require analysis for disposal. And a large quantity of finished and off-spec products, mostly in powder form, that will need to be sampled and bulked into roll-offs for disposal.

This site is located in the City of Middletown, Town of Wallkill, which is in Orange County in the State of New York. The nearest residence is within 0.25 miles to the:

<input type="checkbox"/> North	<input type="checkbox"/> South	<input type="checkbox"/> East	<input type="checkbox"/> West
<input checked="" type="checkbox"/> Northeast	<input type="checkbox"/> Southeast	<input type="checkbox"/> Northwest	<input type="checkbox"/> Southwest

The site is a:

<input type="checkbox"/> battery reclamation	<input type="checkbox"/> neighborhood	<input type="checkbox"/> wood preservation facility
<input checked="" type="checkbox"/> chemical manufacture	<input type="checkbox"/> salvage yard	<input type="checkbox"/> solvent recovery
<input type="checkbox"/> drum recycling	<input type="checkbox"/> private residence	<input type="checkbox"/> tannery
<input type="checkbox"/> incinerator/smelter	<input type="checkbox"/> refinery	<input type="checkbox"/> warehouse
<input type="checkbox"/> landfill	<input type="checkbox"/> resource recovery	<input type="checkbox"/> waste facility
<input type="checkbox"/> metal plating	<input type="checkbox"/> retail gas station	<input type="checkbox"/> other _____

located on seven (9) acres which are:

<input type="checkbox"/> still active	<input checked="" type="checkbox"/> now abandoned	<input type="checkbox"/> unknown
---------------------------------------	---	----------------------------------

It was abandoned in October 2004.

F

The following remedial units are present at the site:

- |  |   |   |
|--|---|---|
| <input checked="" type="checkbox"/> buildings  | <input type="checkbox"/> landfill                 | <input type="checkbox"/> surface water              |
| <input type="checkbox"/> drainage ditch        | <input checked="" type="checkbox"/> process area  | <input checked="" type="checkbox"/> tank farm       |
| <input checked="" type="checkbox"/> drums      | <input type="checkbox"/> roads/access ways        | <input checked="" type="checkbox"/> vats            |
| <input type="checkbox"/> groundwater           | <input type="checkbox"/> soil                     | <input type="checkbox"/> waste pile                 |
| <input type="checkbox"/> impoundment           | <input type="checkbox"/> storage area             | <input checked="" type="checkbox"/> totes           |
| <input checked="" type="checkbox"/> laboratory | <input checked="" type="checkbox"/> storage tanks | <input checked="" type="checkbox"/> reactor vessels |
| <input type="checkbox"/> lagoon                | <input type="checkbox"/> stormwater pond          |   |

The following types of materials were handled at the site:

- |   |  |  |  |
|---|--|--|--|
| <input checked="" type="checkbox"/> acids   | <input checked="" type="checkbox"/> bases    | <input checked="" type="checkbox"/> inorganics | <input checked="" type="checkbox"/> organics |
| <input type="checkbox"/> petroleum products | <input checked="" type="checkbox"/> solvents | <input type="checkbox"/> volatile organics     | <input type="checkbox"/> unknown             |

The contaminants of concern are:

Contaminant	Concentration Range
Hydrochloric Acid	Unknown
Sulfuric Acid	Unknown
Aluminum ingots	Unknown
Zirconium oxychloride	Unknown
Zirconium basic carbonate	Unknown
Chromium	Unknown
Lead	Unknown
Sodium Carbonate	Unknown
Magnesium Carbonate	Unknown
Calcium Carbonate	Unknown
Polyquaternary amine	Unknown
Polydimethyldiallylammonium chloride	Unknown
Polyaluminum hydrochlorosulfate	Unknown
Aluminum hydrochlorate	Unknown
Aluminum Zirconium salts	Unknown
Various Organic Solvents	Unknown

The volumes of contaminated materials to be addressed are:

- |  |  |                                      |   |
|--|--|--------------------------------------|---|
| <input checked="" type="checkbox"/> pounds                             | <input checked="" type="checkbox"/> tons         | <input type="checkbox"/> cubic yards | <input checked="" type="checkbox"/> rolloff         |
| <input checked="" type="checkbox"/> 5 gallon                           | <input checked="" type="checkbox"/> 20-55 gallon | <input type="checkbox"/> 85 gallon   | <input checked="" type="checkbox"/> 100-1000 gallon |
| <input checked="" type="checkbox"/> tanks ( Greater than 1,000 gallon) |  |                                      |   |

The suspected contamination is a result of:

- |   |                               |                                |                                  |
|---|-------------------------------|--------------------------------|----------------------------------|
| <input type="checkbox"/> accident                               | <input type="checkbox"/> fire | <input type="checkbox"/> spill | <input type="checkbox"/> unknown |
| <input checked="" type="checkbox"/> improper waste and disposal |                               |                                |                                  |

The physical/chemical threat to the population and/or environment is:

☐ high                      ☒ moderate                      ☐ minimal

The following sampling constraints have been identified:

- ☐ there have not been any sampling constraints identified to date.  
☒ There is very little room between the top of the holding tanks and the roof of the facility which in turn makes it difficult to collect a sample from the tank. An opening will have to be cut in the top of several of the tanks in order to collect a sample from the tank. A bacon bomb will be utilized to collect samples from the holding tanks referenced above.

The following additional information is known about the site:

On 2/10/05 the Town of Wallkill, Assistant Code Enforcement Officer performed an inspection at this site along with a member of the Orange County Hazardous Materials Response Team. After the inspection, the Assistant Code Enforcement Officer notified NYSDEC. The NYSDEC found various petroleum ethers and miscellaneous organic ethers in unknown stages of decomposition. There were also waste acids that were in uncovered containers. Further, there were large quantities of sulfuric acid and nitric acid in carboys, miscellaneous alcohols, glycols, acetone, and reagent chemicals.

Information gathered at the facility indicates that the facility was shut down in the Fall of 2004. The power had been turned off in the building and the sprinkler system was non-operational. The initial walk through of the building did not reveal any leaking chemical containers. The Town Code Enforcement Officer declared the building to be unsafe under the town ordinance.

Since the initial inspection of this site, NYSDEC, through the bankruptcy trustee, has restored power and heat to this building, and a contractor was hired to stabilize and remove the potentially shock sensitive chemicals from this site. NYSDEC contractors have also brought some corrosive materials from the plant storage yard to the inside of the plant building. Inspections of the facility have revealed large quantities of hydrochloric and sulfuric acids in bulk storage at this site, and numerous small containers of reagents, off-spec chemicals, and chemical intermediaries within the plant buildings.

The current stage/phase of the project is:

☐ assessment                      ☐ emergency response                      ☐ remedial                      ☒ cleanup  
☐ investigative                      ☐ other \_\_\_\_\_

## 2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The United State Environmental Protection Agency (USEPA) On-Scene Coordinator (OSC)/Remedial Project Manager (RPM) will provide overall direction to the Earth Tech staff concerning project objectives, sampling needs, and schedule.

The Earth Tech Project Manager (PM)/Response Manager (RM) is the primary contact with the USEPA OSC/RPM. The PM/RM is responsible for the development and completion of the Quality Assurance Sampling and Analysis Plan (QASAP), project team organization, and supervision of all project tasks.

### 3.0 DATA QUALITY OBJECTIVE RATIONALE

Data quality objectives (DQOs) are qualitative and quantitative statements developed by data users to specify the quality of data from field and laboratory data collection activities to support specific decisions or regulatory actions. The DQOs describe what data are needed, why the data are needed, and how the data will be used to address the problem being investigated. DQOs also establish numeric limits for the data to allow the data user (or reviewers) to determine whether data collected are of sufficient quality for use in their intended application. Two types of data can be generated from the sampling objective: screening data and definitive data.

#### 3.1 Screening Objectives

The objective of screening data is to afford one with a quick and preliminary assessment of the site contamination. This objective for data quality is available for data collection activities that involve rapid, non-rigorous methods of analysis and quality assurance. This objective allows for the collection of the greatest amount of data with the least expenditure of time and money. The end user of the data should be aware that data collected for this objective have neither definitive identification of pollutants nor definitive quantitation of their concentration level.

Although there is no quality assurance data collected with this objective, a calibration or performance check of the method is required along with verification of the detection level. The screening objective does not preclude the adherence to prescribed quality control checks given in USEPA methods and standard operating procedures (SOPs) or the manufacturer's recommendations.

The screening objective is generally applied to but not limited to the following activities: physical and/or chemical properties of samples; extent and degree of contamination relative to concentration differences; delineation of pollutant plume in ground water (head space or soil gas analysis techniques); monitor well placement; waste compatibility; preliminary health and safety assessment; hazardous categorization; and preliminary identification and quantitation of pollutants.

#### 3.2 Definitive Objective:

The definitive objective is used to assess the accuracy of the concentration level as well as the identity of the analyte(s) of interest from the analytical field or lab results. This quality objective is intended to give the decision-maker a level of confidence for a select group of critical samples so he/she can make a decision based on an action level with regard to treatment, disposal, site remediation and/or removal of pollutants, health risk or environmental impact, cleanup verification, pollutant source identification, delineation of contaminants, and other significant decisions where an action level is of concern.

Analyte-specific methods must be used for this quality objective. This objective is generally applied to (but not limited to) the following activities: physical and/or chemical properties of samples, extent and degree of contamination, verification of pollutant plume definition in groundwater, verification of human and safety assessment, verification of pollutant identification, and verification of cleanup.

The USEPA has requested Earth Tech to complete the task as outlined in the delivery order. The DQO of this sampling event is to evaluate the potential health risks and environmental impacts, while determining the profile characteristics of the waste, for either off-site disposal or possible on-site stabilization.

Table 1 outlines the project-specific DQOs.



**Table 1 Project-Specific Data Quality Objects**

Data Quality Objective	Project-Specific Action
Problem statement	The previous owner of Westwood Chemicals left large quantities of product and chemical waste at the facility when it was shut down in October 2004. Historical activities at the site caused the facility to become contaminated, which poses a risk to human health and the surrounding environment.
Identify the decisions	Evaluate the potential health risks and environmental impacts, while determining the profile characteristics of the waste off-site disposal.
Identify inputs to the decision	Compare the analytical results to the hazardous waste characteristics to determine if the waste is hazardous or non-hazardous.
Define boundary of project	The site boundaries and a facility layout are in Appendix E of this QASAP.
Develop the decision rule	If the material is hazardous it should be managed under Subtitle C. If the material is non-hazardous then it should be managed as a non-RCRA hazardous waste.
Specify limits on decision errors	A 95% confidence level is specified for this project.

### 3.3 General Description of DQOs

The usability of the data is matched to the DQOs. A number of factors relate to the quality of data and sample collection methods and are as important to consider as methods used for sample analysis. Following SOPs for both sample collection and analysis reduces sampling and analytical error. Complete chain-of-custody documentation and adherence to required sample preservation techniques, holding times, and proper shipment methods ensure sample integrity. Earth Tech employs trained, experienced technicians capable of all forms of sampling techniques. By utilizing trained personnel and following detailed site-specific sampling procedures, Earth Tech will maintain the data quality at the site level. Obtaining valid and comparable data also requires adequate Quality Assurance/ Quality Control (QA/QC) procedures and documentation, as well as established detection and control limits.

“Valid data” is defined as results that are generated when the instrument and quality controls are within the designated limits. Data validation procedures are designed to systematically review data quality and to assign qualifiers that indicate limited usability of other data.

### 3.4 Measurement of Data Quality

Earth Tech’s QA objective is to ensure that environmental monitoring data of known and acceptable quality are collected to sufficiently characterize the hazardous and non-hazardous material for disposal, and to support cleanup actions at the site. To meet this goal, the following quality control parameters will be evaluated: precision, accuracy, representativeness, comparability, and completeness. These parameters will be evaluated by the laboratory during analyses and will be evaluated by Earth Tech during the final data validation. The precision and accuracy criteria presented in Appendix A will be utilized for data validation if laboratory-generated precision and accuracy criteria are not available.

### 3.4.1 Precision

Precision is a measure of mutual agreement among individual measurements of the same property under prescribed and similar conditions.

Precision of the measurement data for this project will be based upon duplicate analyses (replicability), control sample analyses (repeatability), and results for duplicate field samples (sample replicability). A field duplicate is defined as a sample that is divided into two equal parts for the purpose of analysis. Field duplicates will be collected for all sample matrices and analyzed for all parameters. Discretely sampled field duplicates are useful in determining sampling variability. However, greater than expected differences between duplicates may occur because of variability in the sample material. Field duplicates shall be used as a quality control measure to monitor precision relative to sample collection activities.

Analytical precision shall be evaluated by using matrix spike/matrix spike duplicates (MS/MSDs), laboratory control samples (LCSs) or by using sample duplicates. Precision is calculated in terms of relative percent difference (RPD). RPDs must be compared to the laboratory-established RPD for the analysis. Precision of duplicates may depend on sample homogeneity. The analyst or his/her supervisor must investigate the cause of data outside stated acceptance limits. Corrective action may include recalibration, re-analysis of QC samples, sample re-analysis, or flagging the data as suspect if problems cannot be resolved.

### 3.4.2 Accuracy

Accuracy is the degree of agreement of a measurement or average of measurements with an accepted reference or "true" value. Accuracy is a measure of bias in the system.

Accuracy of the measurement data will be assessed and controlled as follows. Results for blanks, matrix, laboratory control, and surrogate spikes will be the primary indicators of accuracy. These results will be used to control accuracy within acceptable limits by requiring that they meet specific criteria. As spiked samples are analyzed, spike recoveries will be calculated and compared to pre-established acceptance limits.

Acceptance limits will be based upon previously established laboratory capabilities for similar samples using control chart techniques. In this approach, the control limits reflect the minimum and maximum recoveries expected for individual measurements for an in-control system. Recoveries outside the established limits indicate some assignable cause, other than normal measurement error, and the need for corrective action. This includes recalibration of the instrument, re-analysis of the QC sample, re-analysis of the samples in the batch, or flagging the data as suspect if the problem cannot be resolved. Recovery of matrix spikes may depend on sample homogeneity.

### 3.4.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. The characteristics of representativeness are usually not quantifiable. Subjective factors to be taken into account are as follows:

- Degree of homogeneity of a site;
- Degree of homogeneity of a sample taken from one point in a site; and
- Available information on which a sampling plan is based.

Field duplicates, as defined under precision, are also used to assess representativeness. Two samples collected at the same location and at the same time are considered to be equally representative of this condition, at a given point in space and time. To maximize representativeness of results, sampling techniques, sample size, and sample locations will be carefully chosen to provide laboratory samples representative of the site and the specific area. For instance, soil samples are likely to be less homogeneous than liquid waste samples, and thus it is important for the sampler and analyst to follow SOPs when collecting soil samples. Samples exhibiting obvious stratification or lithologic changes should not be used as replicates. Within the laboratory, precautions are taken to extract from the sample container an aliquot representative of the whole sample. However, samples requiring analysis of volatile organic compounds (VOCs) should not be mixed.

#### **3.4.4 Comparability**

Comparability expresses the confidence with which one data set can be compared to another data set measuring the same property. Comparability is ensured through the use of established and approved sample collection techniques and analytical methods, consistency in the basis of analysis, consistency in reporting units, and analysis of standard reference materials.

The use of standard methods to collect and analyze samples, along with instruments calibrated against Standard Analytical Reference Materials (SARMs), which are National Institute for Standards and Technology (NIST) traceable standards, will also ensure comparability.

Comparability also depends on the other data quality characteristics. Only when data are judged to be representative of the environmental conditions, and when precision and accuracy are known, can data sets be compared with confidence.

#### **3.4.5 Completeness**

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under controlled laboratory conditions.

Data completeness is a measure of the extent to which the database resulting from a measurement effort fulfills objectives for the amount of data required. Completeness is defined as the valid data percentage of the total tests requested.

Valid analyses are defined as those where the sample arrived at the laboratory intact, properly preserved, in sufficient quantity to perform the requested analyses, and accompanied by a completed chain-of-custody form. Furthermore, the sample must be analyzed within the specified holding time and in such a manner that analytical QC acceptance criteria are met.

### **3.5 Special Training Requirements/Certifications**

Personnel assigned to the site, including field personnel and subcontractors, will be qualified to perform the tasks to which they are assigned. Each staff member will have the education, training, technical knowledge, and experience to perform assigned functions.

Training shall be provided, if needed, to achieve initial proficiency; maintain proficiency; and adapt to changes in technology, methods, or job responsibilities. Training will be documented on the appropriate form, and placed in the site file as a record.

# F

Site personnel will receive an orientation to the appropriate work plans, including this QASAP, and the Health and Safety Plan (HASP), as appropriate to their responsibilities before participation in site activities. The Earth Tech PM/RM or a qualified designee will provide training of field personnel. Training of laboratory personnel will be the responsibility of the subcontractor laboratory. Copies of personnel training and qualification records will be kept on file in the form of resumes and training and orientation records. Subcontractor records will be reviewed during audits. Earth Tech records maintenance is the responsibility of the PM/RM.

The frequency of sample collection is outlined in Table 2 below.

**Table 2 Field Sampling Summary**

Analytical Parameters	Matrix	Subtotal Samples	Trip Blanks*	Field Blanks**	Equipment Blanks***	Duplicate Samples <sup>1</sup>	MS/MSD Samples <sup>1</sup>	Total Field Samples
VOA (8260B)	Rinse water, solids, product, solvents, unknowns	up to 100	1 per cooler	1 per day	1 per day	1 per 20	1 per 20	up to 140
BNA (8270C)	Rinse water, solids, product, solvents, unknowns	up to 100	NA	1 per day	1 per day	1 per 20	1 per 20	up to 130
PCB (8082)	Oil, unknowns	up to 20	NA	1 per day	1 per day	1 per 20	1 per 20	up to 30
TAL Metals (6010/7000) plus Zirconium	Rinse water, solids, product, solvents, unknowns	up to 100	NA	1 per day	1 per day	1 per 20	1 per 20	up to 130
TCLP-VOA (1311/8260B)	Rinse water, solids, product, solvents, unknowns	up to 100	NA	1 per day	1 per day	1 per 20	1 per 20	up to 130
TCLP-BNA (1311/8270C)	Rinse water, solids, product, solvents, unknowns	up to 100	NA	1 per day	1 per day	1 per 20	1 per 20	up to 130
TOX (9020B)	Rinse water, solids, product, solvents, unknowns	up to 20	NA	1 per day	1 per day	1 per 20	1 per 20	up to 30
EOX (9023)	Rinse water, solids, product, solvents, unknowns	up to 20	NA	1 per day	1 per day	1 per 20	1 per 20	up to 30
Ignitability (1010)	Rinse water, solids, product, solvents, unknowns	up to 100	NA	1 per day	1 per day	1 per 20	NA	up to 120

# F

Analytical Parameters	Matrix	Subtotal Samples	Trip Blanks*	Field Blanks**	Equipment Blanks***	Duplicate Samples <sup>1</sup>	MS/MSD Samples <sup>1</sup>	Total Field Samples
Reactivity (SW-846 Ch 7)	Rinse water, solids, product, solvents, unknowns	up to 100	NA	1 per day	1 per day	1 per 20	1 per 20	up to 130
TCLP Metals (1311/6010B/7470A)	Rinse water, solids, product, solvents, unknowns	up to 100	NA	1 per day	1 per day	1 per 20	1 per 20	up to 130
Corrosivity (9040B)	Rinse water, solids, product, solvents, unknowns	up to 100	NA	1 per day	1 per day	1 per 20	NA	up to 120
Ammonia, Nitrates, Nitrites Sulfate, %Ash	Rinse water, solids, product, solvents, unknowns	up to 20	NA	1 per day	1 per day	1 per 20	1 per 20	up to 30
Chlorides, TSS, TS, TDS, Specific gravity	Rinse water, solids, product, solvents, unknowns	up to 100	100	1 per day	1 per day	1 per 20	1 per 20	up to 130
TOC (9060) Phenols (9065/9066)	Rinse water, solids, product, solvents, unknowns	up to 20	NA	1 per day	1 per day	1 per 20	1 per 20	up to 30
Acidity, Alkalinity	Rinse water, solids, product, solvents, unknowns	up to 20	NA	1 per day	1 per day	1 per 20	NA	up to 25
BTU	Rinse water, solids, product, solvents, unknowns	up to 20	NA	1 per day	1 per day	1 per 20	NA	up to 25
Asbestos	solids, unknowns	up to 20	NA	NA	NA	1 per 20	NA	up to 25
Paint Filter	solids, unknowns	up to 20	NA	NA	NA	1 per 20	NA	up to 25
% Water	Rinse water, solids, product, solvents, unknowns	up to 20	NA	NA	NA	1 per 20	NA	up to 25

**Notes:**

<sup>1</sup> Note required for QA-1 (screening)

\* Trip blanks will be required for environmental samples but not for waste samples

\*\* Field blanks will be performed at a rate of two per day, once per four-hour sampling period.

\*\*\*Equipment blanks will be performed at a rate of two per day per piece of equipment that has been decontaminated. If dedicated equipment is utilized there will not be a need for a rinsate blank.

**Table 3 Data Quality Objectives for Removal Activities**

Sampling Objective	Data Type
<input type="checkbox"/> Emergency Response	Screening
<input type="checkbox"/> Emergency Response	Definitive
<input checked="" type="checkbox"/> Determine identification of contaminants	Screening
<input checked="" type="checkbox"/> Determine identification of contaminants	Definitive
<input type="checkbox"/> Extent of contamination	Screening
<input type="checkbox"/> Extent of contamination	Definitive
<input checked="" type="checkbox"/> Treatment and disposal options	Screening
<input checked="" type="checkbox"/> Treatment and disposal options	Definitive

**Table 4 Data Quality Objectives for Site Assessment Activities**

Sampling Objective	Data Type
<input type="checkbox"/> Treatment and disposal options	Screening
<input type="checkbox"/> Treatment and disposal options	Definitive
<input type="checkbox"/> Quantity of contamination	Screening
<input type="checkbox"/> Quantity of contamination	Definitive
<input type="checkbox"/> Determine identification of contaminants	Screening
<input type="checkbox"/> Determine identification of contaminants	Definitive

The required confidence level for definitive data is:

☐ 85%                      ☐ 90%                      ☒ 95%

Rational for confidence levels less than 95% is: \_\_\_\_\_

#### 4.0 SAMPLING DESIGN

The following waste streams will be sampled as indicated in Table 5.

**Table 5 Contaminant Sources, Recommended Analysis, and Proposed Methods**

Sample Source	Contaminant Sources	Recommended Analysis	Analytical Methods
<input checked="" type="checkbox"/> Recyclable Solvents	Containers and drums	Ignitability	1010
		Corrosivity pH	9040B
		Reactivity	SW-846 7.3.3.2, 7.3.4.2
		TCL Volatiles	8260B
		TCL Semivolatiles	8270C
		PCBs	8082
		TAL Metals	6010B/7000A/7470A
		TCLP Volatiles	1311/8260B
		TCLP Semivolatiles	1311/8270C
		TCLP Metals	1311/6010B/7000A/7470A
		Density	SM213E
		Total Organic Halogens (TOX)	9020B

**E**

Sample Source	Contaminant Sources	Recommended Analysis	Analytical Methods
		% ASH	1209/D2974
		BTU	BTU- D240-76
		% Water	Karl Fischer
		Chlorine content	SW-846 5050/9056
<input checked="" type="checkbox"/> Recyclable Feedstock	containers, drums, tanks	Ignitability	1010
		Corrosivity pH	9040B
		Reactivity	SW-846 7.3.3.2, 7.3.4.2
		PCBs	8082
		TCL Volatiles	8260B
		TCL Semivolatiles	8270C
		TAL Metals + Zirconium	6010B/7000 /7470A/7471A
		TCLP Volatiles	1311/8260B
		TCLP Semivolatiles	1311/8270C
		TCLP Metals	1311/6010B/7000A/7470A/7471A
		Density	SM213E
		Total Organic Halogens	9020B
		% ASH	1209/D2974
		BTU	BTU- D240-76
		% Water	Karl Fischer
		Chloride content	SW-846 9056/EPA 300.0
		Sulfate content	SW-846 9056/EPA 300.0
		Paint Filter Test (free liquids)	9095A
<input checked="" type="checkbox"/> Corrosive (Acidic)	containers, drums, totes, vats	Ignitability	1010
		Acidity	EPA 305
		Corrosivity pH	9040B
		Reactivity	SW-846 7.3.3.2, 7.3.4.2
		TCLP Volatiles	1311/8260B
		TCLP Semivolatiles	1311/8270C
		TCLP Metals	1311/6010B/7000A/7470A
		TAL Metals + Zirconium	6010B/7000A/7470A
		Density	SM213E
		Total Organic Halogens (TOX)	9020B
		Total Organic Carbon (TOC)	9060
		Chlorides	9056/9012/9253
		Sulfates	9056/9038
		Nitrates	9056
<input checked="" type="checkbox"/> Corrosive (Basic)	containers	Ignitability	1010
		Alkalinity	EPA 310
		Corrosivity pH	9040B
		TCLP Volatiles	1311/8260B
		TCLP Semivolatiles	1311/8270C
		TCLP Metals	1311/6010B/7000A/7470A
		TAL Metals + Zirconium	6010B/7000A/7470A
		Density	SM213E

# F

Sample Source	Contaminant Sources	Recommended Analysis	Analytical Methods
<input checked="" type="checkbox"/> Neutral Water	drums, totes, tanks, rinse and decon water	Ignitability	1010
		Corrosivity pH	9040B
		Reactivity	SW-846 7.3.3.2, 7.3.4.2
		TCLP Volatiles	1311/8260B
		TCLP Semivolatiles	1311/8270C
		TCLP Metals	1311/6010B/7000A/7471A
		TCL Volatiles	8260B
		TCL Semivolatiles	8270C
		TAL Metals + Zirconium	6010B/7000A/7471A
		Density	SM213E
		Total Organic Halogens (TOX)	9020B
		Total Organic Carbon (TOC)	9060
		Total Solids	EPA 160.3
		Total Suspended Solids	EPA 160.2
		Total Dissolved Solids	EPA 160.1
		Acidity	EPA 305.1
		Alkalinity	EPA 310.1/310.2
		Total Ammonia	EPA 350.2
<input checked="" type="checkbox"/> Neutral Inert Solids	product, containers, tanks	Ignitability	1010
		Corrosivity pH	9040B
		Reactivity	SW-846 7.3.3.2, 7.3.4.2
		TCLP Volatiles	1311/8260B
		TCLP Semivolatiles	1311/8270C
		TCLP Metals	1311/6010B/7000A/7471A
		TCL Volatiles	8260B
		TCL Semivolatiles	8270C
		TAL Metals + Zirconium	6010B/7000A/7471A
		Density	SM213E
		Total Organic Halogens (TOX)	9020B
		Total Solids	EPA 160.3
		% Water	Karl Fischer
		Paint Filter Test (free liquids)	9095A
<input checked="" type="checkbox"/> Debris	crushed drums, totes, and tanks, PPE	Ignitability	1010
		Corrosivity pH	9040B
		Reactivity	SW-846 7.3.3.2, 7.3.4.2
		PCBs	8082
		TCLP Volatiles	1311/8260B
		TCLP Semivolatiles	1311/8270C
		TCLP Metals	1311/6010B/7000A/7471A
		TCL Volatiles	8260B
		TCL Semivolatiles	8270C
		TAL Metals + Zirconium	6010B/7000A/7471A
		Paint Filter Test (free liquids)	9095A
		Density	SM213E
<input type="checkbox"/> Soil <sup>2</sup>	contaminated soil	Corrosivity pH	9040B



**F**

Sample Source	Contaminant Sources	Recommended Analysis	Analytical Methods
<input type="checkbox"/> Soil <sup>2</sup>	contaminated soil	Reactivity	SW-846 7.3.3.2, 7.3.4.2
		PCBs	8082
		TCLP Volatiles	1311/8260B
		TCLP Semivolatiles	1311/8270C
		TCLP Metals	1311/6010B/7000/7471A
		TCL Volatiles	8260B
		TCL Semivolatiles	8270C
		TAL Metals + Zirconium	6010B/7000A/7471A
		Density	SM213E
		Total Organic Halogens	9020B
		Total Phenols	9065/9066/9067
		Paint Filter Test (free liquids)	9095A
		Total Solids	EPA 160.3
<input checked="" type="checkbox"/> Site Debris	Debris piles	Ignitability	1010
		Corrosivity pH	9040B
		Reactivity	SW-846 7.3.3.2, 7.3.4.2
		PCBs	8082
		TCLP Volatiles	1311/8260B
		TCLP Semivolatiles	1311/8270C
		TCLP Metals	1311/6010B/7000A/7471A
		TCL Volatiles	8260B
		TCL Semivolatiles	8270C
		TAL Metals + Zirconium	6010B/7000A/7471A
		Density	SM213E
		Paint Filter Test (free liquids)	9095A

**Notes:**

<sup>1</sup> No analytical may be required if the material is cleaned in accordance with the standard in 40 CFR Part 268.45.

<sup>2</sup> Some states may require additional parameters than those listed (i.e., Pennsylvania's Form U).

Appendix B contains a brief description of the various sampling approaches listed in Table 6.

**Table 6 Sampling Approaches**

Type of Sample	Sampling Approach	Background Sample Collection	Composite Scheme*
<input checked="" type="checkbox"/> Drum Liquid	Judgmental	NA	<input type="checkbox"/> 1 or <input checked="" type="checkbox"/> 2
<input type="checkbox"/> Drum Liquid	Random	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input checked="" type="checkbox"/> Drum Solid	Judgmental	NA	<input type="checkbox"/> 1 or <input checked="" type="checkbox"/> 2
<input type="checkbox"/> Drum Solid	Random	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Drum Solid	Systematic Random	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input checked="" type="checkbox"/> Tank Liquid	Judgmental	NA	<input type="checkbox"/> 1 or <input checked="" type="checkbox"/> 2
<input type="checkbox"/> Tank Liquid	Random	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Tank Liquid	Stratified Random	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Tank Liquid	Systematic Random	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Tank Liquid	Systematic Grid	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input checked="" type="checkbox"/> Tank Solid	Judgmental	NA	<input type="checkbox"/> 1 or <input checked="" type="checkbox"/> 2
<input type="checkbox"/> Tank Solid	Random	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Tank Solid	Stratified Random	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Tank Solid	Systematic Random	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Tank Solid	Systematic Grid	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input checked="" type="checkbox"/> Waste Pile	Judgmental	NA	<input type="checkbox"/> 1 or <input checked="" type="checkbox"/> 2
<input type="checkbox"/> Waste Pile	Random	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Waste Pile	Stratified Random	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Waste Pile	Systematic Random	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Waste Pile	Systematic Grid	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Waste Pile	Hot Spots	NA	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input checked="" type="checkbox"/> Soil	Judgmental	<input type="checkbox"/> Y or <input checked="" type="checkbox"/> N	<input type="checkbox"/> 1 or <input checked="" type="checkbox"/> 2
<input type="checkbox"/> Soil	Random	<input type="checkbox"/> Y or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Soil	Stratified Random	<input type="checkbox"/> Y or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Soil	Systematic Random	<input type="checkbox"/> Y or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Soil	Systematic Grid	<input type="checkbox"/> Y or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Soil	Hot Spots	<input type="checkbox"/> Y or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Sediment	Judgmental	<input type="checkbox"/> Y or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Sediment	Random	<input type="checkbox"/> Y or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Sediment	Stratified Random	<input type="checkbox"/> Y or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Sediment	Systematic Random	<input type="checkbox"/> Y or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Sediment	Systematic Grid	<input type="checkbox"/> Y or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Groundwater	Random	<input type="checkbox"/> Y or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Groundwater	Systematic Random	<input type="checkbox"/> Y or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Surface water	Judgmental	<input type="checkbox"/> upstream or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Surface water	Random	<input type="checkbox"/> upstream or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2
<input type="checkbox"/> Surface water	Systematic Random	<input type="checkbox"/> upstream or <input type="checkbox"/> N	<input type="checkbox"/> 1 or <input type="checkbox"/> 2

\*The composite schemes are as follows:

1 = Samples will not be composited.

2 = Samples exhibiting like characteristics will be composited and a grab sample taken from the composite. Samples to be analyzed for volatile organics will not be composited.

## 5.0 SAMPLING REQUIREMENTS AND COLLECTIONS

Table 7, Sampling Requirements Summary, contains information pertinent to sampling, such as the sample container types and the quantity to be collected at each sampling location, the preservation method to be utilized, and the sample holding times (based on the parameter being analyzed for and the matrix).

**Table 7 Sampling Requirements Summary**

Analytical Group	Soil/Sediment			Water/Wastewater <sup>1</sup>			Waste		
	Cont	Pres	Hold	Cont	Pres	Hold	Cont	Pres	Hold
<b>Biological</b>									
Bacteriological <sup>2</sup>	--	--	--	B	I	6hr	--	--	--
Toxicity, Acute	--	--	--	CU	I	2	--	--	--
Toxicity, Chronic	--	--	--	CU	I	2	--	--	--
<b>Inorganics</b>									
pH <sup>3</sup>	8G	NA	--	--	--	--	8G	NA	N
Dermal Corrosion	--	--	--	--	--	--	8G	NA	N
Flashpoint	--	--	--	--	--	--	8G	NA	N
BTU Content	--	--	--	--	--	--	8G	NA	N
Ash Content	--	--	--	--	--	--	8G	NA	N
Residual Chlorine <sup>4</sup>	--	--	--	SM	NA	I	--	--	--
Turbidity	--	--	--	SM	I	2	--	--	--
Conductivity	--	--	--	SM	I	28 <sup>11</sup>	--	--	--
Temperature	--	--	--	SM	NA	I	--	--	--
BOD <sub>5</sub>	--	--	--	HP <sup>2</sup>	I	2	--	--	--
Solids Series	--	--	--	HP	I	7	--	--	--
Settleable Solids	--	--	--	HP	I	2	--	--	--
Nutrients (N,P)	8G	I	NS	HP	S/I	28	--	--	--
Chloride	--	--	--	LP	NA	28	--	--	--
Ortho-P	8G	I	NS	LP	I <sup>4</sup>	2	--	--	--
Dissolved P	--	--	--	LP	S <sup>4</sup> /I	28	--	--	--
COD	8G	I	NS	LP	S/I	28	--	--	--
Alkalinity	--	--	--	LP	I	14	--	--	--
Color	--	--	--	GP	I	2	--	--	--
Oil & Grease <sup>5</sup>	--	--	--	LG	S/I	28	--	--	--
Metals	8G	I	180	LP	N	180	8G	NA	180
Mercury	8G	I	28	LP	N	28	8G	NA	28
Metals - TCLP (except Mercury)	8G	I	360 <sup>12</sup>	LP	I	360 <sup>12</sup>	8G	NA	360 <sup>12</sup>
Mercury - TCLP	8G	I	56 <sup>19</sup>	LP	I	56 <sup>19</sup>	8G	NA	56 <sup>19</sup>
Chromium VI	--	--	--	LP	I	1	--	--	--
Cyanide	--	--	--	LP	A <sup>3</sup> /C <sup>6</sup> /I	14	8G	NA	14
Sulfides	--	--	--	LP	Z/C <sup>1</sup> /I	7	--	--	--
Sulfates	--	--	--	LP	I	28	--	--	--
Nitrite	--	--	--	LP	I	2	--	--	--
Nitrate	--	--	--	HP	I	2	--	--	--
Hardness	--	--	--	LP	N	180	--	--	--
Fluoride	--	--	--	LP	NA	28	--	--	--
<b>Organics</b>									

Analytical Group	Soil/Sediment			Water/Wastewater <sup>1</sup>			Waste		
	Cont	Pres	Hold	Cont	Pres	Hold	Cont	Pres	Hold
VOCs*	2G	I	14	V	B <sup>8</sup> /I	14/7 <sup>16</sup>	8G	NA	14
VOCs - TCLP*	2G	I	28 <sup>13</sup>	V	I	28 <sup>13</sup>	8G	NA	28 <sup>13</sup>
Extractables <sup>19</sup>	8G	I	54 <sup>18</sup>	GG	I <sup>9</sup>	47 <sup>17</sup>	8G	NA	54 <sup>18</sup>
Extractables - TCLP	8G	I	61 <sup>14</sup>	GG	I	61 <sup>14</sup>	8G	NA	61 <sup>14</sup>
Dioxins <sup>20</sup>	A	I	75 <sup>15</sup>	LA <sup>3</sup>	I <sup>10</sup>	75 <sup>15</sup>	A	I	75 <sup>15</sup>
Percent Alcohol	8G	I	NS	GG	I	NS	8G	NA	NS
Phenols	--	--	--	LA	S/I	28	--	--	--
Org Halide (TOX)	8G	I	28	LA	S/I	28	--	--	--

General Footnotes:

Cont - Container

Pres - Preservation

Hold - Holding Time (days)

\* - Grab sample only, unless indicated a grab or composite is acceptable.

1 - Consult 40 CFR Part 136 Table II. - Required Containers, Preservation Techniques, and Holding Times for latest requirements.

19 - Including pesticides, herbicides and PCBs

20 - Consult local laboratory for most recent dioxin container and preservation requirements.

Containers:

B - Bacteriological container

CU - Cubitainer: one gallon or 2 gallon

8G - 8 oz. widemouth glass (Teflon lid)

2G - 2 oz. widemouth glass (Teflon septum lid)

LP - One liter polyethylene

GG - One gallon amber glass (Teflon lid)

V - 40 ml glass (Teflon septum lid)

SM - Stormore 500 ml polyethylene

LG - One liter widemouth glass (Teflon lid)

GP - Gallon polyethylene

HP - Half-gallon polyethylene

LA - One liter amber glass (Teflon lid)

A - 500 ml widemouth amber glass (Teflon lid)

2 - Use GP for BOD with multiple parameters

3 - Collect 2 sample containers (LA) per sample plus 4 at one location for matrix spike

Preservatives:

A - Ascorbic acid

B - Sodium bisulfite

C - NaOH

H - HCl

I - Ice (4oC)

N - 50% HNO<sub>3</sub> (pH < 2.0 S.U.)

NA - Not applicable

S - 50% H<sub>2</sub>SO<sub>4</sub> (pH < 2.0 S.U.)

Z - Zinc acetate

# F

- 4 - Filter on-site
- 5 - Only with residual CL2
- 6 - To pH > 12.0 S.U.
- 7 - To pH > 9.0 S.U.
- 8 - With residual CL2 mix sample in 8-oz. glass container with 8 drops 25% ascorbic acid
- 9 - With residual CL2 mix sample with 0.008% sodium thiosulfate
- 10 - With residual CL2 mix sample with 80 mg of sodium thiosulfate per liter

Holding Times: in days unless noted otherwise:

- NS - Not Specified
- N - Indefinite
- I - Immediate (within 15 minutes: 40 CFR 136 Table II)
- 11 - Determine on-site if possible
- 12 - 360 days: 180 days to extraction plus 180 days to analysis
- 13 - 28 days: 14 days to TCLP extraction plus 14 days to analysis (7 days if not preserved following extraction)
- 14 - 61 days: 14 days to TCLP extraction, 7 days to solvent extraction, 40 days to analysis
- 15 - Method 8290 specifies 30 days to extraction plus 45 days to analysis
- 16 - 7 days if not preserved
- 17 - 47 days: 7 days to extraction, 40 days to analysis
- 18 - 54 days: 14 days to extraction, 40 days to analysis
- 19 - 56 days: 28 days to extraction plus 28 days to analysis

Table 8 shows the sampling equipment/media will be used to obtain environmental samples from the respective matrix.

**Table 8 Sampling Equipment/Media**

Parameter/Matrix	Equipment/Media	Fabrication	Dedicated
<input checked="" type="checkbox"/> TCLP/Drum & tote Liquid	Drum Thief	Glass	Yes
<input checked="" type="checkbox"/> TCLP/Drum & tote Liquid	Coliwasas	Glass	Yes
<input checked="" type="checkbox"/> TCLP/ Drum Solid	Coring device	PVC	Yes
<input type="checkbox"/> TCLP/ Drum Solid	Coring device	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input checked="" type="checkbox"/> TCLP/ Drum Solid	Scoops/Spoon	PVC	<input checked="" type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TCLP/ Waste Pile	Spoon	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TCLP/ Waste Pile	Sample Thief	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input checked="" type="checkbox"/> TCLP/ Tank Liquid	Bacon Bomb	Stainless Steel	<input type="checkbox"/> Y / <input checked="" type="checkbox"/> N
<input checked="" type="checkbox"/> TCLP/ Tank Liquid	Coliwasas	Glass	Yes
<input checked="" type="checkbox"/> TCLP/ Tank Solid	Scoops/Spoon	PVC	Yes
<input checked="" type="checkbox"/> TCLP/ Tank Solid	Coring device	PVC	<input checked="" type="checkbox"/> Y / <input type="checkbox"/> N
<input checked="" type="checkbox"/> TCL/Drum & tote Liquid	Drum Thief	Glass	Yes
<input checked="" type="checkbox"/> TCL/Drum & tote Liquid	Coliwasas	Glass	Yes
<input checked="" type="checkbox"/> TCL/ Drum Solid	Scoops/Spoon	PVC	<input checked="" type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TCL/ Waste Pile	Spoon	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TCL/ Waste Pile	Sample Thief	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N

# F

Parameter/Matrix	Equipment/Media	Fabrication	Dedicated
<input checked="" type="checkbox"/> TCL/ Tank Liquid	Bacon Bomb	Stainless Steel	<input type="checkbox"/> Y / <input checked="" type="checkbox"/> N
<input type="checkbox"/> TCL/ Tank Liquid	Coliwasa	Glass	Yes
<input checked="" type="checkbox"/> TAL/Drum & tote Liquid	Drum Thief	Glass	Yes
<input checked="" type="checkbox"/> TAL/Drum & tote Liquid	Coliwasa	Glass	Yes
<input checked="" type="checkbox"/> TAL/ Drum Solid	Scoops/Spoon	PVC	<input checked="" type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TAL/ Waste Pile	Spoon	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TAL/ Waste Pile	Sample Thief	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input checked="" type="checkbox"/> TAL/ Tank	Bacon Bomb	Stainless Steel	<input type="checkbox"/> Y / <input checked="" type="checkbox"/> N
<input type="checkbox"/> TAL/ Tank	Coliwasa	Glass	Yes
<input type="checkbox"/> TCLP/Sediment	Dredges	Stainless Steel/Brass	No
<input type="checkbox"/> TCLP/Sediment	Coring	Stainless Steel or Teflon	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TCLP/Sediment	Scoops/Spoon	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TCL/Sediment	Dredges	Stainless Steel/Brass	No
<input type="checkbox"/> TCL/Sediment	Coring	Stainless Steel or Teflon	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TCL/Sediment	Scoops/Spoon	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TAL/Sediment	Dredges	Stainless Steel/Brass	No
<input type="checkbox"/> TAL/Sediment	Coring	Stainless Steel or Teflon	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TAL/Sediment	Scoops/Spoon	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TCLP/Soil	Spoon/Trowel	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TCLP/ Soil	Hand Auger	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TCLP/ Soil	Drill Rig/Back hoe	Carbon Steel	No
<input type="checkbox"/> TCL/ Soil	Spoon/Trowel	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TCL/ Soil	Hand Auger	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TCL/ Soil	Drill Rig/Back hoe	Carbon Steel	No
<input type="checkbox"/> TAL/ Soil	Spoon/Trowel	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TAL/ Soil	Hand Auger	Stainless Steel	<input type="checkbox"/> Y / <input type="checkbox"/> N
<input type="checkbox"/> TAL/ Soil	Drill Rig/Back hoe	Carbon Steel	No

## 5.1 Sample Collection

The totes that contain rinse water with a pH greater than 3 and less than 8 will be pumped into empty holding tanks. When the tanks are full a five gallon composite sample will be collected from each holding tank. A bacon bomb will be used to collect grab samples from various depths in the holding tank. The individual grab samples will be poured into a five gallon bucket. Appendix F contains list the depths at which individual samples will be collected in order to make the composite sample. Upon completion of the sampling from the holding tank an aliquot of sample will be collected from the five gallon bucket and sent to the analytical testing laboratory for analysis.

The totes that contain rinse water with a pH less than or equal to 3 or greater than or equal to 8 will be segregated and sampled separately from those totes that contain rinse water with a pH greater than 3 and less than 8. A Coliwasa or glass thief will be used to collect a representative sample from each tote. Samples collected from totes that are believed to be from the same process line and that are compatible will be composited to form one sample.

Drums will be sampled in accordance with the drum sampling SOP. Drums containing liquids will be sampled using a Coliwasa or a glass thief. A coring device will be used to collect samples from drums containing solids.

Samples collected from drums that are believed to be from the same process line and that are compatible will be composited together. Samples that are not compatible will be kept separate and analyzed independently from the composite samples.

Tanks will be sampled in accordance with the tank sampling SOP. Tanks that contain liquids will be sampled with a bacon bomb. A bacon bomb will be used to collect grab samples from various depths in the tank. The individual grab samples will be poured into a five gallon bucket. Appendix "F" lists the depths at which individual samples will be collected in order to make the composite sample. Upon completion of the sampling from the holding tank an aliquot of sample will be collected from the five gallon bucket and sent to the analytical testing laboratory for analysis.

Tanks that contain a solid or semisolid product will be sampled using either a coring device or a PVC spoon/scoop. Samples collected from tanks that are believed to be from the same process line and that are compatible will be composited together. Samples that are not compatible will be kept separate and analyzed independently from the composite samples.

Super sacks will be sampled by cutting an opening in the top of the super sack and a grab sample will be collected using a spoon or scoop.

The quality control samples stored in the basement that are believed to be from the same process line and that are compatible will be emptied into a drum to form one composite sample. Liquid samples will be collected from the drum using a Coliwasa or glass thief while solid samples will be collected using a coring device or spoon. Once the sample has been collected it will be sent to the analytical testing laboratory for analysis. The empty glass containers will be placed into a separate drum. Samples that are not compatible will be kept separate and analyzed independently from the composite samples.

The samples stored in the R&D laboratories that are believed to be from the same process line and that are compatible will be emptied into a drum to form one composite sample. Liquid samples will be collected from the drum using a Coliwasa or glass thief while solid samples will be collected using a coring device or spoon. Once the sample has been collected it will be sent to the analytical testing laboratory for analysis. The empty containers will be placed into a separate drum. Samples that are not compatible will be kept separate and analyzed independently from the composite samples.

## 6.0 SAMPLING STANDARD OPERATING PROCEDURES

The following sampling SOPs will be implemented for this project (copies included in Appendix C) as applicable. These are typically procedures that may be varied or changed as required, dependent upon site conditions or equipment limitations. In all instances, the ultimate procedures employed should be documented and associated with the final project deliverables.

- Drum Sampling
- Waste Pile Sampling
- Tank Sampling
- Filed Characterization Testing

Field decontamination procedures are outlined in Appendix D.

## 7.0 SAMPLING DOCUMENTATION

All sample documents will be completed legibly and in ink. Any corrections will be made by lining-through the original entry and initialing the change.

### 7.1 Field Logbook

All sample documents will be completed legibly and in ink. Any corrections will be made by lining through the original entry and initialing the change. The following sample documentation will be maintained as necessary:

- Site name
- Names of personnel on site
- Dates and times of all entries
- Descriptions of all site activities
- Noteworthy events and discussions
- Weather conditions
- Site observations
- Identification and description of samples and locations
- Subcontractor information and names of on-site personnel
- Dates and times of sample collection and Chain of Custody (COC) information
- Records of photographs
- Site sketches
- Sample Labels
- Site name and project number
- Date and time the sample was collected
- Sample preservation
- Sampling location
- Chain-of Custody Record
- Sample identification
- Sample location
- Sample collection date and time
- Sample information (e.g., matrix, number of bottles, etc.)
- Names and signatures of samplers
- Signatures of all individuals who have had custody of the samples

### 7.2 Sampling Handling and Shipment

Environmental samples will be packaged and shipped as described below.

1. Samples will be shipped per Department of Transportation (DOT) and International Air Transportation Association (IATA) guidelines.
2. All sample containers will be placed in waterproof metal or equivalent plastic ice chests or coolers only.
3. After the pertinent information is on the sample label and tag, if required, the tag is secured around the sample container lid.
4. The volume level of the sample in the sample container is marked with a grease pencil.
5. Cushioning material is placed in the bottom of the cooler.



6. The bottles are sealed in clear plastic bags, with labels and tags clearly visible. The enclosed are placed upright in the cooler so that they do not touch during transit.
7. Temperature blanks are used to monitor cooler temperature.
8. Ice bags are placed around, among, and on top of the sample bottles.
9. The cooler is filled with cushioning material.
10. Paperwork is placed in a waterproof plastic bag and closed.
11. The cooler drain is taped shut.
12. The cooler lid is secured with tape by wrapping it around the cooler in at least two places without covering any labels.
13. Completed shipping label is attached to the top of the cooler.
14. If needed, numbered and signed custody seals are affixed on front right and back left of the cooler. The seals are covered with wide, clear tape.
15. Samples will be express-shipped (overnight) to the laboratory under COC protocols previously discussed.

## 8.0 QUALITY ASSURANCE REQUIREMENTS

The following QA requirements will be implemented on this project:

☒ Screening Data

☒ Definitive Data

### 8.1 Screening Data

Screening data are generated by rapid less precise methods of analysis with less rigorous sample preparation. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and clean up. Screening data provide analyte identification and quantification, although the quantification may be relatively imprecise. At least 10% of the screening data are confirmed using the analytical method and QA/QC procedures and criteria associated with definitive data. Screening data without associated confirmation data are not considered to be data of known quality.

Screening data QA/QC Elements:

- Sample documentation
- Chain of Custody
- Sampling design approach
- Initial and continuing calibration
- Determination and documentation of detection limits
- Analyte(s) identification
- Analyte(s) quantification

### 8.2 Definitive Data

Definitive data are generated using rigorous analytical methods, such as approved USEPA reference methods. Data are analyte-specific, with confirmation of analyte identification and concentration. Methods produce tangible raw data in the form of printouts or computer-generated electronic files. For data to be definitive, either analytical or total error must be determined. Analytical error determination measures overall precision of the analytical method. Total measurement error determination measures overall precision of the measurement system, from sample acquisition through analysis.

**Definitive Data QA/QC Elements:**

- Sample results summary
- Cross reference sample ID (laboratory/client)
- Sample holding times
- Detection limits and qualifiers
- Internal and external chain of custody documentation
- Initial and continuing calibration data
- Interference check sample (ICP)
- ICP serial dilution
- Initial and continuing blank data (inorganics)
- Method blanks (instrument, extraction, etc.)
- Surrogate spike data with control limits
- Matrix spike/matrix spike duplicate with control limits (organics)
- Matrix spike and duplicate with control limits (inorganics)
- Laboratory Control Sample with control limits
- Internal standard area count and retention time with control limits
- GC/MS tuning criteria
- Second column confirmation data
- Raw data
- A case narrative to include cleanup and dilution procedures and interference's encountered
- Performance Evaluation samples (when required)

## **9.0 DATA VALIDATION**

Data generated for this project will be validated as follows:

### **9.1 Screening Data**

Screening data need only be evaluated for calibration and detection limits. Confirmation data generated under this QASAP will be evaluated accordingly with the appropriate criteria listed in Section 8.0 above.

### **9.2 Definitive Data**

This objective requires that at least 10% of the samples in the analytical data package be evaluated for all of the elements listed in Section 8.0 of this QASAP. The remaining samples will be reviewed for holding times, blank contamination, precision, accuracy, detection limits, and confirmed compound identification. This objective also requires review of all elements for all samples in each analyte category in every tenth data package received from the individual lab.

## **10.0 DELIVERABLES**

The Earth Tech PM/RM will maintain contact with the USEPA OSC/RPM to provide information regarding the technical and financial progress of the project. This communication will begin when the project is assigned. **All solid/soil/sediment samples that are analyzed for PCBs are required to be reported on a dry-weight basis.**

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The items checked below will be included as standard deliverables.

☐ Analysis  
☐ Final Report  
☐ Trip Report

☒ Analytical Report  
☐ Maps and Figures

☒ Data Review  
☐ Status Report

## **Appendix A**

### **Precision and Accuracy Criteria**

### Estimated Reporting Limits for Method 8260B

Analyte Volatile Organic Compounds SW-8260B	Aqueous Samples		Soil Samples
	Estimated Reporting Limit <sup>(b)</sup> (µg/L) 5 ml purge	Estimated Reporting Limit <sup>(b)</sup> (µg/L) 25 ml purge	Estimated Reporting Limit <sup>(b)</sup> (µg/kg) Low level Soil/sediment
Dichlorodifluoromethane	5	1	5
Chloromethane	5	1	5
Vinyl chloride	5	1	5
Bromomethane	5	1	5
Chloroethane	5	1	5
Trichlorofluoromethane	5	1	5
1,1-Dichloroethene	5	1	5
Methylene chloride	5	1	5
trans-1,2-Dichloroethene	5	1	5
1,1-Dichloroethane	5	1	5
2,2-Dichloropropane	5	1	5
cis-1,2-Dichloroethene	5	1	5
Chloroform	5	1	5
Bromochloromethane	5	1	5
1,1,1-Trichloroethane	5	1	5
Carbon tetrachloride	5	1	5
1,1-Dichloropropene	5	1	5
Benzene	5	1	5
1,2-Dichloroethane	5	1	5
Trichloroethene	5	1	5
1,2-Dichloropropane	5	1	5
Bromodichloromethane	5	1	5
Dibromomethane	5	1	5
cis-1,3-Dichloropropene	5	1	5
Toluene	5	1	5
Trans-1,3-Dichloropropene	5	1	5
1,1,2-Trichloroethane	5	1	5
Tetrachloroethene	5	1	5
1,3-Dichloropropane	5	1	5
Dibromochloromethane	5	1	5
1,2-Dibromoethane	5	1	5
1-Chlorohexane	5	1	5
Chlorobenzene	5	1	5
1,1,1,2-Tetrachloroethane	5	1	5
Ethyl benzene	5	1	5
p-Xylene	5	1	5
m-Xylene	5	1	5
o-Xylene	5	1	5
Styrene	5	1	5
Bromoform	5	1	5
Isopropylbenzene	5	1	5
1,1,2,2-Tetrachloroethane	5	1	5
Bromobenzene	5	1	5
1,2,3-Trichloropropane	5	1	5
n-Propylbenzene	5	1	5
2-Chlorotoluene	5	1	5
1,3,5-Trimethylbenzene	5	1	5

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Analyte Volatile Organic Compounds SW-8260B	Aqueous Samples		Soil Samples
	Estimated Reporting Limit <sup>(b)</sup> (µg/L) 5 ml purge	Estimated Reporting Limit <sup>(b)</sup> (µg/L) 25 ml purge	Estimated Reporting Limit <sup>(b)</sup> (µg/kg) Low level Soil/sediment
4-Chlorotoluene	5	1	5
tert-Butylbenzene	5	1	5
1,2,4-Trimethylbenzene	5	1	5
sec-Butylbenzene	5	1	5
p-Isopropyltoluene	5	1	5
1,3-Dichlorobenzene	5	1	5
1,4-Dichlorobenzene	5	1	5
n-Butylbenzene	5	1	5
1,2-Dichlorobenzene	5	1	5
1,2-Dibromo-3-chloropropane	5	1	5
1,2,4-Trichlorobenzene	5	1	5
Hexachlorobutadiene	5	1	5
Naphthalene	5	1	5
1,2,3-Trichlorobenzene	5	1	5

# QC Acceptance Criteria for Method 8260B

Analyte Volatile Organic Compounds SW-8260B	Accuracy Water (%R)	Precision Water (% RPD)	Accuracy Soil (%R)	Precision Soil (% RPD)
Dichlorodifluoromethane	75-125	< 20	65-140	< 30
Chloromethane	75-125	< 20	65-140	< 30
Vinyl chloride	40-125	< 20	30-145	< 30
Bromomethane	75-125	< 20	65-140	< 30
Chloroethane	60-125	< 20	50-140	< 30
Trichlorofluoromethane	65-125	< 20	55-140	< 30
1,1-Dichloroethene	75-125	< 20	65-140	< 30
Methylene chloride	75-125	< 20	65-140	< 30
trans-1,2-Dichloroethene	75-125	< 20	65-140	< 30
1,1-Dichloroethane	75-125	< 20	65-140	< 30
2,2-Dichloropropane	75-125	< 20	65-140	< 30
cis-1,2-Dichloroethene	75-125	< 20	65-140	< 30
Chloroform	75-125	< 20	65-140	< 30
Bromochloromethane	75-125	< 20	65-140	< 30
1,1,1-Trichloroethane	75-125	< 20	65-140	< 30
Carbon tetrachloride	60-125	< 20	50-140	< 30
1,1-Dichloropropene	75-125	< 20	65-140	< 30
Benzene	75-125	< 20	65-140	< 30
1,2-Dichloroethane	65-125	< 20	65-140	< 30
Trichloroethene	75-125	< 20	65-140	< 30
1,2-Dichloropropane	75-125	< 20	65-140	< 30
Bromodichloromethane	75-125	< 20	65-140	< 30
Dibromomethane	65-125	< 20	55-140	< 30
cis-1,3-Dichloropropene	75-125	< 20	65-140	< 30
Toluene	75-125	< 20	65-140	< 30
Trans-1,3-Dichloropropene	65-125	< 20	55-140	< 30
1,1,2-Trichloroethane	75-125	< 20	65-140	< 30
Tetrachloroethene	75-125	< 20	65-140	< 30
1,3-Dichloropropane	75-125	< 20	65-140	< 30
Dibromochloromethane	70-125	< 20	60-140	< 30
1,2-Dibromoethane	75-125	< 20	65-140	< 30
1-Chlorohexane	75-125	< 20	65-140	< 30
Chlorobenzene	75-125	< 20	65-140	< 30
1,1,1,2-Tetrachloroethane	75-125	< 20	65-140	< 30
Ethyl benzene	75-125	< 20	65-140	< 30
p-Xylene	75-125	< 20	65-140	< 30
m-Xylene	75-125	< 20	65-140	< 30
o-Xylene	75-125	< 20	65-140	< 30
Styrene	75-125	< 20	65-140	< 30
Bromoform	75-125	< 20	65-140	< 30
Isopropylbenzene	75-125	< 20	65-140	< 30
1,1,2,2-Tetrachloroethane	75-125	< 20	65-140	< 30
Bromobenzene	75-125	< 20	65-140	< 30
1,2,3-Trichloropropane	75-125	< 20	65-140	< 30
n-Propylbenzene	75-125	< 20	65-140	< 30
2-Chlorotoluene	75-125	< 20	65-140	< 30
1,3,5-Trimethylbenzene	70-125	< 20	60-140	< 30
4-Chlorotoluene	75-125	< 20	65-140	< 30

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Analyte Volatile Organic Compounds SW-8260B	Accuracy Water (%R)	Precision Water (% RPD)	Accuracy Soil (%R)	Precision Soil (% RPD)
tert-Butylbenzene	75-125	< 20	65-140	< 30
1,2,4-Trimethylbenzene	75-125	< 20	65-140	< 30
sec-Butylbenzene	75-125	< 20	65-140	< 30
p-Isopropyltoluene	75-125	< 20	65-140	< 30
1,3-Dichlorobenzene	75-125	< 20	65-140	< 30
1,4-Dichlorobenzene	75-125	< 20	65-140	< 30
n-Butylbenzene	75-125	< 20	65-140	< 30
1,2-Dichlorobenzene	75-125	< 20	65-140	< 30
1,2-Dibromo-3-chloropropane	55-125	< 20	40-140	< 30
1,2,4-Trichlorobenzene	75-125	< 20	65-140	< 30
Hexachlorobutadiene	75-125	< 20	65-140	< 30
Naphthalene	75-125	< 20	65-140	< 30
1,2,3-Trichlorobenzene	75-125	< 20	65-140	< 30
<b>Surrogates</b>				
Dibromofluoromethane	75-125		65-140	
Toluene-d8	75-125		65-140	
4-Bromofluorobenzene	75-125		65-140	
1,2-Dichloroethane-d4	60-140		50-150	



### Estimated Reporting Limits for Method 8270C

Analyte Semi-volatile Organic Compounds SW-8270C	Aqueous Samples	Soil Samples
	Estimated Reporting Limit (µg/l)	Estimated Reporting Limit (µg/kg) Low level Soil/sediment
Acenaphthene	10	660
Acenaphthylene	10	660
Anthracene	10	660
Benzo(a)anthracene	10	660
Benzo(b)fluoranthene	10	660
Benzo(k)fluoranthene	10	660
Benzoic acid	50	3300
Benzo(g,h,i)perylene	10	660
Benzo(a)pyrene	10	660
Benzyl alcohol	20	1300
Bis(2-Chloroethoxy) methane	10	660
Bis(2-Chloroethyl) ether	10	660
Bis(2-Chloroisopropyl) ether	10	660
4-Bromophenyl phenyl ether	10	660
Butyl benzyl phthalate	10	660
4-Chloroaniline	20	1300
4-Chloro-3-methylphenol	20	1300
2-Chloronaphthalene	10	660
2-Chlorophenol	10	660
4-Chlorophenyl phenyl ether	10	660
Chrysene	10	660
Dibenz(a,h)anthracene	10	660
Dibenzofuran	10	660
Di-n-butylphthalate	10	660
1,2-Dichlorobenzene	10	660
1,3-Dichlorobenzene	10	660
1,4-Dichlorobenzene	10	660
3,3'-Dichlorobenzidine	20	1300
2,4-Dichlorophenol	10	660
Diethylphthalate	10	660
2,4-Dimethylphenol	10	660
Dimethyl phthalate	10	660
4,6-Dinitro-2-methylphenol	50	3300
2,4-Dinitrophenol	50	3300
2,4-Dinitrotoluene	10	660
2,6-Dinitrotoluene	10	660
Di-n-octyl phthalate	10	660
bis(2-Ethylhexyl)phthalate	10	660
Ethyl methanesulfonate	20	ND
Fluoranthene	10	660
Fluorene	10	660
Hexachlorobenzene	10	660
Hexachlorobutadiene	10	660
Hexachlorocyclopentadiene	10	660
Hexachloroethane	10	660
Indeno(1,2,3-cd)pyrene	10	660

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Analyte Semi-volatile Organic Compounds SW-8270C	Aqueous Samples	Soil Samples
	Estimated Reporting Limit (µg/l)	Estimated Reporting Limit (µg/kg) Low level Soil/sediment
Isophorone	10	660
2-Methylnaphthalene	10	660
2-Methylphenol	10	660
4-Methylphenol	10	660
Naphthalene	10	660
2-Nitroaniline	50	3300
3-Nitroaniline	50	3300
4-Nitroaniline	20	3300
Nitrobenzene	10	660
2-Nitrophenol	10	660
4-Nitrophenol	50	3300
N-Nitrosodiphenylamine	10	660
N-Nitroso-di-n-propylamine	10	660
Pentachlorophenol	50	3300
Phenanthrene	10	660
Phenol	10	660
Pyrene	10	660
1,2,4-Trichlorobenzene	10	660
2,4,5-Trichlorophenol	10	660
2,4,6-Trichlorophenol	10	660

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QC Acceptance Criteria for Method 8270C

Analyte Semi-volatile Organic Compounds SW-8270C	Accuracy Water (%R)	Precision Water (% RPD)	Accuracy Soil (%R)	Precision Soil (% RPD)
Acenaphthene	45-125	< 20	35-135	< 30
Acenaphthylene	45-125	< 20	35-135	< 30
Anthracene	45-165	< 20	35-175	< 30
Benzo(a)anthracene	50-135	< 20	40-145	< 30
Benzo(b)fluoranthene	35-125	< 20	25-135	< 30
Benzo(k)fluoranthene	35-125	< 20	25-135	< 30
Benzoic acid	25-160	< 20	20-170	< 30
Benzo(g,h,i)perylene	35-150	< 20	25-160	< 30
Benzo(a)pyrene	40-125	< 20	30-135	< 30
Benzyl alcohol	35-125	< 20	25-135	< 30
bis(2-Chloroethoxy) methane	45-125	< 20	35-135	< 30
bis(2-Chloroethyl) ether	45-125	< 20	30-135	< 30
bis(2-Chloroisopropyl) ether	35-170	< 20	25-175	< 30
4-Bromophenyl phenyl ether	50-130	< 20	40-140	< 30
Butyl benzyl phthalate	25-125	< 20	25-135	< 30
4-Chloroaniline	45-140	< 20	35-150	< 30
4-Chloro-3-methylphenol	40-125	< 20	40-145	< 30
2-Chloronaphthalene	60-125	< 20	50-135	< 30
2-Chlorophenol	40-125	< 20	30-135	< 30
4-Chlorophenyl phenyl ether	50-130	< 20	30-135	< 30
Chrysene	55-135	< 20	45-145	< 30
Dibenz(a,h)anthracene	50-125	< 20	40-135	< 30
Dibenzofuran	50-125	< 20	40-135	< 30
Di-n-butylphthalate	30-130	< 20	25-140	< 30
1,2-Dichlorobenzene	40-160	< 20	30-135	< 30
1,3-Dichlorobenzene	30-125	< 20	25-135	< 30
1,4-Dichlorobenzene	30-125	< 20	25-135	< 30
3,3'-Dichlorobenzidine	25-175	< 20	25-175	< 30
2,4-Dichlorophenol	45-125	< 20	35-135	< 30
Diethylphthalate	35-125	< 20	25-135	< 30
2,4-Dimethylphenol	45-140	< 20	35-150	< 30
Dimethyl phthalate	25-175	< 20	25-175	< 30
4,6-Dinitro-2-methylphenol	25-135	< 20	25-145	< 30
2,4-Dinitrophenol	30-150	< 20	25-160	< 30
2,4-Dinitrotoluene	35-140	< 20	25-150	< 30
2,6-Dinitrotoluene	50-125	< 20	40-135	< 30
Di-n-octyl phthalate	35-130	< 20	25-140	< 30
bis(2-Ethylhexyl)phthalate	30-140	< 20	25-140	< 30
Fluoranthene	45-125	< 20	35-135	< 30
Fluorene	45-140	< 20	35-150	< 30
Hexachlorobenzene	45-135	< 20	35-145	< 30
Hexachlorobutadiene	25-125	< 20	25-135	< 30
Hexachlorocyclopentadiene	40-125	< 20	30-135	< 30
Hexachloroethane	25-135	< 20	25-160	< 30
Indeno(1,2,3-cd)pyrene	25-160	< 20	25-170	< 30
Isophorone	25-175	< 20	25-175	< 30
2-Methylnaphthalene	40-125	< 20	30-135	< 30
2-Methylphenol	25-125	< 20	25-135	< 30

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Analyte Semi-volatile Organic Compounds SW-8270C	Accuracy Water (%R)	Precision Water (% RPD)	Accuracy Soil (%R)	Precision Soil (% RPD)
4-Methylphenol	30-125	≤ 20	25-135	≤ 30
Naphthalene	50-125	≤ 20	40-135	≤ 30
2-Nitroaniline	50-125	≤ 20	40-135	≤ 30
3-Nitroaniline	50-125	≤ 20	40-135	≤ 30
4-Nitroaniline	40-145	≤ 20	30-155	≤ 30
Nitrobenzene	45-135	≤ 20	35-145	≤ 30
2-Nitrophenol	40-125	≤ 20	35-135	≤ 30
4-Nitrophenol	25-135	≤ 20	25-140	≤ 30
N-Nitrosodiphenylamine	25-125	≤ 20	25-135	≤ 30
N-Nitroso-di-n-propylamine	35-125	≤ 20	25-135	≤ 30
Pentachlorophenol	25-140	≤ 20	35-150	≤ 30
Phenanthrene	50-125	≤ 20	40-135	≤ 30
Phenol	25-125	≤ 20	25-135	≤ 30
Pyrene	45-140	≤ 20	35-150	≤ 30
1,2,4-Trichlorobenzene	40-140	≤ 20	30-150	≤ 30
2,4,5-Trichlorophenol	25-175	≤ 20	25-175	≤ 30
2,4,6-Trichlorophenol	35-130	≤ 20	25-140	≤ 30
<b>Surrogates:</b>				
2,4,6-Tribromophenol	25-135		25-145	
2-Fluorobiphenyl	40-125		30-135	
2-Fluorophenol	25-125		25-135	
Nitrobenzene-d5	30-125		25-135	
Phenol-d5	25-125		25-135	
Terphenyl-d14	40-130		30-140	

### Estimated Reporting Limits for Method 8081A

Analyte Organochlorine Pesticides SW-8081A	GC/ECD Estimated Reporting Limit <sup>(a)</sup> (µg/L)	GC/ECD Estimated Reporting Limit <sup>(b)</sup> (µg/kg)
Aldrin	0.05	1.75
a-BHC	0.05	1.75
b-BHC	0.05	1.75
d-BHC	0.05	1.75
g-BHC	0.05	1.75
a-Chlordane	0.05	1.75
g-Chlordane	0.05	1.75
4,4'-DDD	0.10	3.3
4,4'-DDE	0.10	3.3
4,4'-DDT	0.10	3.3
Dieldrin	0.10	3.3
Endosulfan I	0.05	1.75
Endosulfan II	0.10	3.3
Endosulfan sulfate	0.10	3.3
Endrin	0.10	3.3
Endrin aldehyde	0.10	3.3
Endrin ketone	0.10	3.3
Heptachlor	0.05	1.75
Heptachlor epoxide	0.05	1.75
Methoxychlor	0.50	17
Toxaphene	5.0	170

**Notes:**

- Estimated reporting limits are calculated by multiplying the estimated detection limit times a factor of 10; estimated detection limit defined as either the MDL (40 CFR Part 136, Appendix B, Revision 1.11), or a concentration of analyte in a sample yielding a peak in the final extract with signal-to-noise ratio of approximately 5, whichever value is higher.
- Estimated reporting limits are calculated by multiplying the estimated detection limit times a factor of 10. Detection limits determined from standard solutions corrected back to 50 g samples, extracted and concentrated to 10 mL, with 5 µL injected. Chromatography using narrow bore capillary column.

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**QC Acceptance Criteria for Method 8081A**

Analyte Method 8081A	Accuracy Water (%R)	Precision Water (% RPD)	Accuracy Soil (%R)	Precision Soil (% RPD)
Aldrin	45-125	≤ 30	25-135	≤ 50
a-BHC	75-125	≤ 30	55-135	≤ 50
b-BHC	50-125	≤ 30	35-135	≤ 50
d-BHC	75-125	≤ 30	55-140	≤ 50
g-BHC	70-125	≤ 30	55-135	≤ 50
a-Chlordane	45-125	≤ 30	30-140	≤ 50
g-Chlordane	45-125	≤ 30	30-140	≤ 50
4,4'-DDD	45-140	≤ 30	35-150	≤ 50
4,4'-DDE	45-140	≤ 30	30-150	≤ 50
4,4'-DDT	30-145	≤ 30	20-160	≤ 50
Dieldrin	40-130	≤ 30	30-145	≤ 50
Endosulfan I	50-140	≤ 30	35-155	≤ 50
Endosulfan II	75-160	≤ 30	60-170	≤ 50
Endosulfan sulfate	45-140	≤ 30	30-155	≤ 50
Endrin	45-135	≤ 30	30-145	≤ 50
Endrin aldehyde	75-150	≤ 30	60-160	≤ 50
Endrin ketone	65-135	≤ 30	60-160	≤ 50
Heptachlor	45-130	≤ 30	30-140	≤ 50
Heptachlor epoxide	50-135	≤ 30	40-145	≤ 50
Methoxychlor	70-140	≤ 30	60-155	≤ 50
Toxaphene	40-130	≤ 30	30-140	≤ 50
<b>Surrogates</b>				
DCBP	30-135		30-135	
TMX	40-125		40-125	

### Estimated Reporting Limits for Method 8151A

Analyte Chlorinated Phenoxy Acid Herbicides SW-8151A	Aqueous Samples	Soil Samples
	GC/ECD Estimated Reporting Limit (µg/l)	Estimated Reporting Limit (µg/kg) Low level Soil/sediment
Acifluorfen	0.96	NA
Bentazon	2.0	NA
Chloramben	0.93	40
2,4-D	2.0	1.1
Dalapon	13	1.2
2,4-DB	8.0	NA
DCPA diacid <sup>(d)</sup>	0.2	NA
Dicamba	0.81	NA
3,5-Dichlorobenzoic acid	0.61	3.8
Dichloroprop	2.6	NA
Dinoseb	1.9	NA
5-Hydroxydicamba	4.0	NA
MCPP	0.9 <sup>(c)</sup>	660
MCPA	0.56 <sup>(c)</sup>	430
4-Nitrophenol	1.3	3.4
Pentachlorophenol	0.76	1.6
Picloram	1.4	NA
2,4,5-T	0.8	NA
2,4,5-TP (Silvex)	0.75	2.8

**Notes:**

- Estimated reporting limits are calculated by multiplying the estimated detection limit times a factor of 10; estimated detection limit defined as either the MDL (40 CFR Part 136, Appendix B, Revision 1.11), or a concentration of analyte in a sample yielding a peak in the final extract with signal-to-noise ratio of approximately 5, whichever value is higher.
- Estimated reporting limits are calculated by multiplying the estimated detection limit times a factor of 10. Detection limits determined from standard solutions corrected back to 50 g samples, extracted and concentrated to 10 mL, with 5 µL injected. Chromatography using narrow bore capillary column, 0.25 µm film, 5% phenyl/95% methyl silicone.
- 40 CFR Part 136, Appendix B (49 FR 43234). Chromatography using wide-bore capillary column.
- DCPA monoacid and diacid metabolites included in method scope; DCPA diacid metabolite used for validation studies. DCPA is a dimethyl ester.

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**QC Acceptance Criteria for Method 8151A**

<b>Analyte Chlorinated Phenoxy Acid Herbicide SW-8151A</b>	<b>Accuracy Water (%R)</b>	<b>Precision Water (% RPD)</b>	<b>Accuracy Soil (%R)</b>	<b>Precision Soil (% RPD)</b>
Acifluorfen	60-125	≤ 30	50-135	≤ 50
Bentazon	60-125	≤ 30	50-135	≤ 50
Chloramben	60-125	≤ 30	50-135	≤ 50
2,4-D	60-125	≤ 30	50-135	≤ 50
Dalapon	60-125	≤ 30	50-135	≤ 50
2,4-DB	60-125	≤ 30	50-135	≤ 50
DCPA diacid <sup>(d)</sup>	60-125	≤ 30	50-135	≤ 50
Dicamba	60-125	≤ 30	50-135	≤ 50
3,5-Dichlorobenzoic acid	60-125	≤ 30	50-135	≤ 50
Dichloroprop	60-125	≤ 30	50-135	≤ 50
Dinoseb	60-125	≤ 30	50-135	≤ 50
5-Hydroxydicamba	60-125	≤ 30	50-135	≤ 50
MCPP	60-125	≤ 30	50-135	≤ 50
MCPA	60-125	≤ 30	50-135	≤ 50
4-Nitrophenol	60-125	≤ 30	50-135	≤ 50
Pentachlorophenol	60-125	≤ 30	50-135	≤ 50
Picloram	60-125	≤ 30	50-135	≤ 50
2,4,5-T	60-125	≤ 30	50-135	≤ 50
2,4,5-TP (Silvex)	60-125	≤ 30	50-135	≤ 50
<b>Surrogates</b>				
2,4-Dichlorophenylacetic acid	60-135	≤ 30	50-150	≤ 50
2,3,5,6-Tetrafluorobenzoic acid	70-130	≤ 30	60-140	≤ 50



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### Estimated Reporting Limits for Method 6010B

Analyte Inorganic Metals SW-6010B	Aqueous Samples	Soil/Sediment Samples
	Estimated Reporting Limit ( µg/l)	Estimated Reporting Limit ( mg/kg)
Aluminum	200	10
Antimony	60	3
Arsenic	10	0.5
Barium	200	10
Beryllium	5	0.25
Cadmium	5	0.25
Calcium	5000	250
Chromium	10	0.5
Cobalt	50	2.5
Copper	10	0.5
Iron	100	5
Lead	3	0.15
Magnesium	5000	250
Manganese	15	0.75
Nickel	40	2
Potassium	5000	250
Selenium	5	0.25
Silver	10	0.5
Sodium	5000	250
Thallium	10	0.5
Vanadium	50	2.5
Zinc	20	1.0

### QC Acceptance Criteria for Method 6010B

Analyte Inorganic Metals SW-6010B	Accuracy Water (%R)	Precision Water (% RPD)	Accuracy Soil (%R)	Precision Soil (% RPD)
Aluminum	75-125	≤ 20	60-140	≤ 35
Antimony	75-125	≤ 20	60-140	≤ 35
Arsenic	75-125	≤ 20	60-140	≤ 35
Barium	75-125	≤ 20	60-140	≤ 35
Beryllium	75-125	≤ 20	60-140	≤ 35
Cadmium	75-125	≤ 20	60-140	≤ 35
Calcium	75-125	≤ 20	60-140	≤ 35
Chromium	75-125	≤ 20	60-140	≤ 35
Cobalt	75-125	≤ 20	60-140	≤ 35
Copper	75-125	≤ 20	60-140	≤ 35
Iron	75-125	≤ 20	60-140	≤ 35
Lead	75-125	≤ 20	60-140	≤ 35
Magnesium	75-125	≤ 20	60-140	≤ 35
Manganese	75-125	≤ 20	60-140	≤ 35
Nickel	75-125	≤ 20	60-140	≤ 35
Potassium	75-125	≤ 20	60-140	≤ 35
Selenium	75-125	≤ 20	60-140	≤ 35
Silver	75-125	≤ 20	60-140	≤ 35
Sodium	75-125	≤ 20	60-140	≤ 35
Thallium	75-125	≤ 20	60-140	≤ 35
Vanadium	75-125	≤ 20	60-140	≤ 35
Zinc	75-125	≤ 20	60-140	≤ 35

### Estimated Reporting Limits for Method SW7470A/SW7471A

Analyte SW-7470A/7471A	Aqueous Samples	Soil Samples
	Estimated Reporting Limit (mg/L)	Estimated Reporting Limit (mg/Kg)
Mercury	0.001	0.1

### QA Acceptance Criteria for Method SW7470A/SW7471A

Analyte SW-7470A/7471A	Accuracy Water (%R)	Precision Water (% RPD)	Accuracy Soil (%R)	Precision Soil (% RPD)
Mercury	75-125	≤ 25	70-130	≤ 30

**F****Estimated Reporting Limits for Method SW9010A/SW9012**

Analyte SW-9010A/9012	Aqueous Samples
	Estimated Reporting Limit (mg/L)
Total cyanide	0.02

**QA Acceptance Criteria for Method SW9010A/SW9012**

Analyte SW-9010A/9012	Accuracy Water (% R)	Precision Water (% RPD)
Total cyanide	75-125	≤ 20

## **Appendix B**

### **Various Sampling Approaches**

## SAMPLING APPROACHES

### Introduction

Development of a sampling design may follow the seven steps outlined in the USEPA publication, "Guidance for the Data Quality Objectives Process." The Data Quality Objectives (DQOs) process is a logical step-by-step method of identifying the study objective, defining the appropriate type of data to collect, clarifying the decisions that will be based on the data collected, and considering the potential limitations with alternate sampling designs. Investigations may be executed without completing the DQO process step-by-step; however, the basic elements of the DQO process should be considered by the project leader for each investigation.

Sampling designs are typically either non-probabilistic (directed sampling designs) or probabilistic (random sampling designs) in nature. The sampling design ultimately must meet specific study objectives. The location and frequency of sampling (number of samples) should be clearly outlined in the sampling design, as well as provisions for access to all areas of the site, the use of special sampling equipment, etc.

### Representative Sampling

A "representative sample" is often defined as a sample that reflects one or more characteristics of the population being sampled. For example, the characteristic, which is desired to be reflected by the sample, may be the average, minimum, or maximum concentration of a constituent of concern. Ultimately a representative sample is defined by the study objectives. For instance, the objective of the study may be to determine the maximum concentration of lead in the sludge from a surface impoundment. One sample collected near the inlet to the impoundment may provide that information. The collection of a representative sample may be influenced by factors such as equipment design, sampling techniques, and sample handling.

### Stratification and Heterogeneous Wastes

Environmental media, as well as waste matrices, may be stratified, i.e., different portions of the population, which may be separated temporally or spatially, may have similar characteristics or properties which are different from adjacent portions of the population. An example would be a landfill that contains a trench, which received an industrial waste contaminated with chromium. The trench would be considered a strata within the landfill if chromium was the contaminant of concern. A special case, "stratification by component", is often observed with waste matrices when the constituent of interest is associated with one component of the matrix. An example would be slag contaminated with lead that is mixed with otherwise uncontaminated firebrick. Thus the lead is stratified by component, that being the slag. Stratified sampling designs are discussed later which incorporate independent sampling of each strata, thereby reducing the number of samples required.

Some environmental and waste matrices may be, for purposes of the field investigation, homogeneous (for instance the surface water in a limited segment of a small stream). If the composition of the matrix and the distribution of contaminants are known, or can be estimated, less sampling may be necessary to define the properties of interest. An estimate of the variability in contaminant distribution may be based on knowledge, or determined by preliminary sampling. The more heterogeneous the matrix, the greater the planning and sampling requirements.

## **Specific Sampling Designs**

Sampling strategies used by the Branch typically fall into two general groups: directed or probabilistic. Directed or "authoritative" approaches typically rely on the judgement and experience of the investigators, as well as available information on the matrix of concern. Probabilistic, or "statistical" approaches may be appropriate when estimates on uncertainty and specific confidence levels in the results are required. The probabilistic approaches include: simple random sampling, stratified random sampling, and systematic grid sampling. The main feature of a probabilistic approach is that each location at the site has an equal probability of being sampled, therefore statistical bias is minimized.

### **Authoritative or Directed Sampling**

Directed sampling is based on the judgement of the investigator, and does not necessarily result in a sample that reflects the average characteristics of the entire matrix. Directed sampling is also called authoritative or judgmental sampling, and is considered non-probabilistic. The experience of the investigator is often the basis for sample collection, and bias (depending on the study objectives) should be recognized as a potential problem. However, preliminary or screening investigations, and certain regulatory investigations, may correctly employ directed sampling. Directed sampling may focus on "worst case" conditions in a matrix, for example, the most visually contaminated area or the most recently generated waste. In the presence of high temporal or spacial variability, directed samples have a very limited degree of representativeness.

### **Simple Random Sampling**

Simple random sampling insures that each element in the population has an equal chance of being included in the sample. This is often be the method of choice when, for purposes of the investigation, the matrix is considered homogeneous or when the population is randomly heterogeneous. If the population contains trends or patterns of contamination, a stratified random sampling or systematic grid sampling strategy would be more appropriate.

### **Systematic Sampling Over Time or Space**

Systematic sampling over time at the point of generation is useful if the material was sampled from a wastewater sewer, a materials conveyor belt, or being delivered via truck or pipeline. The sampling interval would be determined on a time basis, for example every hour from a conveyor belt or pipeline discharge, or from every third truck load. Systematic sampling over space might involve the collection of samples at defined intervals from a ditch, stream, or other matrix that is spatially unique.

### **Stratified Random Sampling**

Stratified random sampling may be useful when distinct strata or "homogeneous sub-groups" are identified within the population. The strata could be located in different areas of the population, or the strata may be comprised of different layers. This approach is useful when the individual strata may be considered internally homogeneous, or at least have less internal variation, in what would otherwise be considered a heterogeneous population. Information on the site is usually required to establish the location of individual strata. A grid may be utilized for sampling several horizontal layers if the strata are horizontally oriented. A simple random sampling approach is typically utilized for sample collection within each strata. The use of a stratified random sampling strategy may result in the collection of fewer samples.

### **Systematic Grid Sampling**

Systematic grid sampling involves the collection of samples at fixed intervals when the contamination is assumed to be randomly distributed. This method is commonly used with populations when estimating trends or patterns of contamination. This approach may not be acceptable if the entire population is not accessible, or if the systematic plan becomes "phased" with variations in the distribution of contaminants within the matrix. This approach may also be useful for identifying the presence of strata within the population. The grid and starting points should be randomly laid out over the site, yet the method allows for rather easy location of exact sample locations within each grid. Also, the grid size would typically be adjusted according to the number of samples that are required.

**Appendix C**  
**Standard Operating Procedures**



**Appendix D**

**Field Decontamination Procedures**

## STANDARD FIELD DECONTAMINATION PROCEDURES

### D.1.0 Introduction

These procedures are intended for use by field personnel for cleaning sampling and other equipment in the field. Emergency field sample container cleaning procedures are also included; however, they should not be used unless absolutely necessary.

Sampling and field equipment cleaned in accordance with these procedures must meet the minimum requirements for Data Quality Objectives (DQO) definitive data collection. Deviations from these procedures should be documented in the approved study plan, field records, and investigative reports.

These are the materials, methods, and procedures to be used when cleaning sampling and other equipment in the field.

### D.1.1 Specifications for Cleaning Materials

Specifications for standard cleaning materials referred to in this appendix are as follows:

- Soap shall be a standard brand of phosphate-free laboratory detergent such as Liquinox®. Use of other detergent must be justified and documented in the field logbooks and inspection or investigative reports.
- Solvent shall be pesticide-grade isopropanol. Use of a solvent other than pesticide-grade isopropanol for equipment cleaning purposes must be justified in the study plan. Otherwise its use must be documented in field logbooks and inspection or investigation reports.
- Tap water may be used from any municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.
- Analyte free water (deionized water) is tap water that has been treated by passing through a standard deionizing resin column. At a minimum, the finished water should contain no detectable heavy metals or other inorganic compounds (i.e., at or above analytical detection limits) as defined by a standard inductively coupled Argon Plasma Spectrophotometer (ICP) (or equivalent) scan. Analyte free water obtained by other methods is acceptable, as long as it meets the above analytical criteria.
- Organic/analyte free water is defined as tap water that has been treated with activated carbon and deionizing units. A portable system to produce organic/analyte free water under field conditions is available. At a minimum, the finished water must meet the analytical criteria of analyte free water and should contain no detectable pesticides, herbicides, or extractable organic compounds, and no volatile organic compounds above minimum detectable levels. Organic/analyte free water obtained by other methods is acceptable, as long as it meets the above analytical criteria.
- Other solvents may be substituted for a particular purpose if required. For example, removal of concentrated waste materials may require the use of either pesticide-grade hexane or petroleum ether. After the waste material is removed, the equipment must be subjected to the standard cleaning procedure. Because these solvents are not miscible with water, the equipment must be completely dry prior to use.

Solvents, laboratory detergent, and rinse waters used to clean equipment shall not be reused during field decontamination.

#### D.1.2 Handling and Containers for Cleaning Solutions

Improperly handled cleaning solutions may easily become contaminated. Storage and application containers must be constructed of the proper materials to ensure their integrity. Following are acceptable materials used for containing the specified cleaning solutions:

- Soap must be kept in clean plastic, metal, or glass containers until used. It should be poured directly from the container during use.
- Solvent must be stored in the unopened original containers until used. They may be applied using the low-pressure nitrogen system fitted with a Teflon® nozzle, or using Teflon® squeeze bottles.
- Tap water may be kept in clean tanks, hand pressure sprayers, squeeze bottles, or applied directly from a hose.
- Analyte free water must be stored in clean glass, stainless steel, or plastic containers that can be closed prior to use. It can be applied from plastic squeeze bottles.
- Organic/analyte free water must be stored in clean glass, Teflon®, or stainless steel containers prior to use. It may be applied using Teflon® squeeze bottles, or with the portable system.

Note: Hand pump sprayers generally are not acceptable storage or application containers for the above materials (with the exception of tap water). This also applies to stainless steel sprayers. All hand sprayers have internal oil coated gaskets and black rubber seals that may contaminate the solutions.

#### D.1.3 Disposal of Solvent Cleaning Solutions

Procedures for the safe handling and disposition of investigation derived waste (IDW), including used wash water, rinse water, and spent solvents will be developed as required.

#### D.1.4 Equipment Contaminated with Concentrated Wastes

Equipment used to collect samples of hazardous materials or toxic wastes or materials from hazardous waste sites, RCRA facilities, or in-process waste streams should be field cleaned before returning from the study. At a minimum, this should consist of washing with soap and rinsing with tap water. More stringent procedures may be required at the discretion of the field investigators.

#### D.1.5 Safety Procedures for Field Cleaning Operations

Some of the materials used to implement the cleaning procedures outlined in this appendix can be harmful if used improperly. Caution should be exercised by all field investigators and all applicable safety procedures should be followed. At a minimum, the following precautions should be taken in the field during these cleaning operations:

- Safety glasses with splash shields or goggles, and latex gloves will be worn during all cleaning operations.

- Solvent rinsing operations will be conducted in the open (never in a closed room).
- No eating, smoking, drinking, chewing, or any hand to mouth contact should be permitted during cleaning operations.

#### **D.1.6 Handling of Cleaned Equipment**

After field cleaning, equipment should be handled only by personnel wearing clean gloves to prevent re-contamination. In addition, the equipment should be moved away (preferably upwind) from the cleaning area to prevent recontamination. If the equipment is not to be immediately re-used it should be covered with plastic sheeting or wrapped in aluminum foil to prevent re-contamination. The area where the equipment is kept prior to re-use must be free of contaminants.

#### **D.2.0 Field Equipment Cleaning Procedures**

Sufficient clean equipment should be transported to the field so that an entire study can be conducted without the need for field cleaning.

However, this is not possible for some specialized items such as portable power augers (Little Beaver®), well drilling rigs, soil coring rigs, and other large pieces of field equipment. In addition, particularly during large-scale studies, it is not practical or possible to transport all of the pre-cleaned field equipment required into the field.

In these instances, sufficient pre-cleaned equipment should be transported to the field to perform at least one days work. The following procedures are to be utilized when equipment must be cleaned in the field.

##### **D.2.1 Specifications for Decontamination Pads**

Decontamination pads constructed for field cleaning of sampling and drilling equipment should meet the following minimum specifications:

- The pad should be constructed in an area known or believed to be free of surface contamination.
- The pad should not leak excessively.
- If possible, the pad should be constructed on a level, paved surface and should facilitate the removal of wastewater. This may be accomplished by either constructing the pad with one corner lower than the rest, or by creating a sump or pit in one corner or along one side. Any sump or pit should also be lined.
- Sawhorses or racks constructed to hold equipment while being cleaned should be high enough above ground to prevent equipment from being splashed.
- Water should be removed from the decontamination pad frequently.
- A temporary pad should be lined with a water impermeable material with no seams within the pad. This material should be either easily replaced (disposable) or repairable.

At the completion of site activities, the decontamination pad should be deactivated. The pit or sump should be backfilled with the appropriate material designated by the site project leader, but only after all waste/rinse water has been pumped into containers for disposal. No solvent rinsates will be placed in the pit. Solvent rinsates should be collected in separate containers for proper disposal. If the decontamination pad has leaked excessively, soil sampling may be required.

#### **D.2.2 "Classic Parameter" Sampling Equipment**

"Classic Parameters" are analyses such as oxygen demand, nutrients, certain inorganics, sulfide, flow measurements, etc.

For routine operations involving classic parameter analyses, water quality sampling equipment such as Kemmerers, buckets, dissolved oxygen dunkers, dredges, etc., may be cleaned with the sample or analyte-free water between sampling locations. A brush may be used to remove deposits of material or sediment, if necessary. If analyte-free water is samplers should be flushed at the next sampling location with the substance (water) to be sampled, but before the sample is collected.

Flow measuring equipment such as weirs, staff gages, velocity meters, and other stream gaging equipment may be cleaned with tap water between measuring locations, if necessary.

The previously described procedures are not to be used for cleaning field equipment to be used for the collection of samples undergoing trace organic or inorganic constituent analyses.

#### **D.2.3 Sampling Equipment used for the Collection of Trace Organic and Inorganic Compounds**

The following procedures are to be used for all sampling equipment used to collect routine samples undergoing trace organic or inorganic constituent analyses:

1. Clean with tap water and soap using a brush if necessary to remove particulate matter and surface films. Equipment may be steam cleaned (soap and high pressure hot water) as an alternative to brushing. Sampling equipment that is steam cleaned should be placed on racks or saw horses at least two feet above the floor of the decontamination pad. PVC or plastic items should not be steam cleaned.
2. Rinse thoroughly with tap water.
3. Rinse thoroughly with analyte free water.
4. Rinse thoroughly with solvent. Do not solvent rinse PVC or plastic items.
5. Rinse thoroughly with organic/analyte free water. If organic/analyte free water is not available, equipment should be allowed to completely dry. Do not apply a final rinse with analyte water. Organic/analyte free water can be generated on-site utilizing the portable system.
6. Remove the equipment from the decontamination area and cover with plastic. Equipment stored overnight should be wrapped in aluminum foil and covered with clean, unused plastic.

#### **D.2.4 Well Sounders or Tapes**

1. Wash with soap and tap water.

2. Rinse with tap water.
3. Rinse with analyte free water.

#### **D.2.5 Fultz® Pump Cleaning Procedure**

*CAUTION - To avoid damaging the Fultz® pump:*

Never run pump when dry

Never switch directly from the forward to the reverse mode without pausing in the "OFF" position

The Fultz® pump should be cleaned prior to use and between each monitoring well. The following procedure is required:

1. Pump a sufficient amount of soapy water through the hose to flush out any residual purge water.
2. Using a brush, scrub the exterior of the contaminated hose and pump with soapy water. Rinse the soap from the outside of the hose with tap water. Rinse the hose with analyte-free water and recoil onto the spool.
3. Pump a sufficient amount of tap water through the hose to flush out all the soapy water (approximately one gallon).
4. Pump a sufficient amount of analyte-free water through the hose to flush out the tap water, then purge with the pump in the reverse mode.
5. Rinse the outside of the pump housing and hose with analyte-free water (approximately 1/4 gal.).
6. Place pump and reel in clean plastic bag.

#### **D.2.6 Goulds® Pump Cleaning Procedure**

*CAUTION - During cleaning always disconnect the pump from the generator.*

The Goulds® pump should be cleaned prior to use and between each monitoring well. The following procedure is required:

1. Using a brush, scrub the exterior of the contaminated hose and pump with soap and tap water.
2. Rinse the soap from the outside of the pump and hose with tap water.
3. Rinse the tap water residue from the outside of pump and hose with analyte-free water.
4. Place the pump and hose in a clean plastic bag.

#### **D.2.7 Redi-Flo2® Pump**

The Redi-Flo2® pump should be cleaned prior to use and between each monitoring well. The following procedure is required:

**CAUTION** - Make sure the pump is not plugged in.

1. Using a brush, scrub the exterior of the pump, electrical cord and garden hose with soap and tap water. Do not wet the electrical plug.
2. Rinse with tap water.
3. Rinse with analyte free water.
4. Place the equipment in a clean plastic bag.

To clean the Redi-Flo2® ball check valve:

1. Completely dismantle ball check valve. Check for wear and/or corrosion, and replace as needed.
2. Using a brush, scrub all components with soap and tap water.
3. Rinse with analyte free water.
4. Reassemble and re-attach the ball check valve to the Redi-Flo2® pump head.

#### **D.2.8 Automatic Sampler Tubing**

The Silastic® and Tygon® tubing previously used in the automatic samplers may be field cleaned as follows:

1. Flush tubing with tap water and soap.
2. Rinse tubing thoroughly with tap water.
3. Rinse tubing with analyte free water.

#### **D.3.0 Downhole Drilling Equipment**

These procedures are to be used for drilling activities involving the collection of soil samples for trace organic and inorganic constituent analyses, and for the construction of monitoring wells to be used for the collection of groundwater samples for trace organic and inorganic constituent analyses.

##### **D.3.1 Introduction**

Cleaning and decontamination of all equipment should occur at a designated area (decontamination pad) on the site. The decontamination pad should meet the specifications of Section D.2.1.

Tap water (potable) brought on the site for drilling and cleaning purposes should be contained in a pre-cleaned tank of sufficient size so that drilling activities can proceed without having to stop and obtain additional water.

A steam cleaner and/or high pressure hot water washer capable of generating a pressure of at least 2500 PSI and producing hot water and/or steam (200° F plus), with a soap compartment, should be obtained.

### D.3.2 Preliminary Cleaning and Inspection

The drill rig should be clean of any contaminants that may have been transported from another hazardous waste site, to minimize the potential for cross-contamination. Further, the drill rig itself should not serve as a source of contaminants. In addition, associated drilling and decontamination equipment, well construction materials, and equipment handling procedures should meet these minimum specified criteria:

- All downhole augering, drilling, and sampling equipment should be sandblasted before use if painted, and/or there is a buildup of rust, hard or caked matter, etc., that cannot be removed by steam cleaning (soap and high pressure hot water), or wire brushing. Sandblasting should be performed prior to arrival on site, or well away from the decontamination pad and areas to be sampled.
- Any portion of the drill rig, backhoe, etc., that is over the borehole (kelly bar or mast, backhoe buckets, drilling platform, hoist or chain pulldowns, spindles, cathead, etc.) should be steam cleaned (soap and high pressure hot water) and wire brushed (as needed) to remove all rust, soil, and other material which may have come from other hazardous waste sites, before being brought on site.
- Printing and/or writing on well casing, tremie tubing, etc. should be removed before use. Emery cloth or sand paper can be used to remove the printing and/or writing. Most well material suppliers can supply materials without the printing and/or writing if specified when ordered.
- The drill rig and other equipment associated with the drilling and sampling activities should be inspected to insure that all oils, greases, hydraulic fluids, etc., have been removed, and all seals and gaskets are intact with no fluid leaks.
- PVC or plastic materials such as tremie tubes should be inspected. Items that cannot be cleaned are not acceptable and should be discarded.

### D.3.3 Drill Rig Field Cleaning Procedure

Any portion of the drill rig, backhoe, etc., that is over the borehole (kelly bar or mast, backhoe buckets, drilling platform, hoist or chain pulldowns, spindles, cathead, etc.) should be steam cleaned (soap and high pressure hot water) between boreholes.

### D.3.4 Field Cleaning Procedure for Drilling Equipment

The following is the standard procedure for field cleaning augers, drill stems, rods, tools, and associated equipment. This procedure does not apply to well casings, well screens, or split-spoon samplers used to obtain samples for chemical analyses, which should be cleaned as outlined in Section D.2.3.



1. Clean with tap water and soap, using a brush if necessary, to remove particulate matter and surface films. Steam cleaning (high-pressure hot water with soap) may be necessary to remove matter that is difficult to remove with the brush. Drilling equipment that is steam cleaned should be placed on racks or saw horses at least two feet above the floor of the decontamination pad. Hollow-stem augers, drill rods, etc., that are hollow or have holes that transmit water or drilling fluids, should be cleaned on the inside with vigorous brushing.
2. Rinse thoroughly with tap water.
3. Remove from the decontamination pad and cover with clean, unused plastic. If stored overnight, the plastic should be secured to ensure that it stays in place.

When there is concern for low level contaminants it may be necessary to clean this equipment between borehole drilling and/or monitoring well installation using the procedure outlined in Section D.2.3.

#### **D.4.0 Emergency Disposable Sample Container Cleaning**

New one-pint or one-quart mason jars may be used to collect samples for analyses of organic compounds and metals in waste and soil samples during an emergency. These containers would also be acceptable on an emergency basis for the collection of water samples for extractable organic compounds, pesticides, and metals analyses. These jars cannot be used for the collection of water samples for volatile organic compound analyses.

The rubber sealing ring should not be in contact with the jar and aluminum foil should be used, if possible, between the jar and the sealing ring.

If possible, the jar and aluminum foil should be rinsed with pesticide-grade isopropanol and allowed to air dry before use. Several empty bottles and lids should be submitted to the laboratory as blanks for quality control purposes.

**Appendix E**  
**Site Boundaries and Facility Layout**

**Appendix F**  
**Tank Height and Sampling Depths**

# F

New Tank #	Old Tank #	Height	Sampling Intervals	Comments
T-001	T-100B	5' 9"	Every 18"	4 grabs at each interval
T-002	FS-1	16' 8"	Every 18"	1 grab at each interval
T-003	FS-2	NA	NA	No flange @ bottom of tank
T-004	FS-3	NA	NA	No flange @ bottom of tank
T-005	T-39C	12'	Every 18"	2 grabs at each interval
T-006	T-39A	12'	Every 18"	2 grabs at each interval
T-007	T-39B	12'	Every 18"	2 grabs at each interval
T-008	T-23A	13'	Every 18"	2 grabs at each interval
T-009	None	4'	Every 18"	6 grabs at each interval
T-010	T-45	13' 4"	Every 18"	2 grabs at each interval
T-011	T-36	17' 5"	Every 18"	1 grab at each interval
T-012	None	5' 4"	Every 18"	4 grabs at each interval
T-013	None	7' 2"	Every 18"	3 grabs at each interval
T-014	T-23	16' 4"	Every 18"	1 grab at each interval
T-015	None	5'	Every 18"	4 grabs at each interval
T-016	R-1	17' 4"	Every 18"	1 grab at each interval
T-017	R-2	15' 7"	Every 18"	1 grab at each interval
T-018	R-3	17' 4"	Every 18"	1 grab at each interval
T-019	R-4	17' 4"	Every 18"	1 grab at each interval
T-020	R-5	16' 7"	Every 18"	1 grab at each interval
T-021	T-34B	26' 8"	Every 18"	1 grab at each interval
T-022	T-34	23' 5"	Every 18"	1 grab at each interval
T-023	T-34A	18' 7"	Every 18"	1 grab at each interval
T-024	R-8	15' 6"	Every 18"	1 grab at each interval
T-025	R-7	17' 4"	Every 18"	1 grab at each interval
T-026	R-6	17' 4"	Every 18"	1 grab at each interval
T-027	R-9	20' 4"	Every 18"	1 grab at each interval
T-028	T-49	16' 5"	Every 18"	1 grab at each interval
T-029	T-40			
T-030	T-43			
T-031	T-60			
T-032	T-61			
T-033	T-62			
T-034	T-50	16'	Every 18"	1 grab at each interval
T-035	T-38	12' 8"	Every 18"	2 grabs at each interval
T-036	T-48	16' 4"	Every 18"	1 grabs at each interval
T-037	T-30	11' 9"	Every 18"	2 grabs at each interval
T-038	T-65	11' 8"	Every 18"	2 grabs at each interval
T-039	T-64	11' 8"	Every 18"	2 grabs at each interval
T-040	None			
T-041	T-41	11' 3"	Every 18"	2 grabs at each interval
T-042	T-35	12'	Every 18"	2 grabs at each interval
T-043	T-46	8' 11"	Every 18"	3 grabs at each interval

**F**

New Tank #	Old Tank #	Height	Sampling Intervals	Comments
T-044	T-63			
T-045	T-71	22'	Every 18"	1 grab at each interval
T-046	T-72	19' 6"	Every 18"	1 grab at each interval
T-047	T-73	17'	Every 18"	1 grab at each interval
T-048	T-51			
T-049	T-52			
T-050	T-53			
T-051	T-54			
T-052	None			
T-053	None			
T-054	T-21	11'	Every 18"	2 grabs at each interval
T-055	None			
T-056	T-32	11'	Every 18"	2 grabs at each interval
T-057	T-31	15' 6"	Every 18"	1 grab at each interval
T-058	None			
T-059	None			
T-060	None			
T-061	None			
T-062	None			
T-063	None			
T-064	T-42	10' 8"	Every 18"	2 grabs at each interval
T-065	T-37	10' 8"	Every 18"	2 grabs at each interval
T-066	T-44	10' 8"	Every 18"	2 grabs at each interval
T-067	T-39	12' 2"	Every 18"	2 grabs at each interval

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## 1.0 INTRODUCTION

Earth Tech has been contracted by the US Environmental Protection Agency (USEPA) to perform sampling, removal, and decontamination services at the former Westwood Chemical Corporation (Westwood) site in Middletown, NY. This Work Plan addresses a site investigation (Subsurface Investigation) to identify the nature and extent of contamination in the soils at the former Westwood site.

### 1.1 Site Background

Westwood Chemical Corporation specialized in developing, manufacturing, and marketing aluminum and zirconium based active ingredients for the cosmetic, toiletry, and water treatment industries. Westwood Chemical produced two major products while in operation, prior to their shutdown. The first, which generated approximately 85-90% of their revenue, was making aluminum-zirconium salts as the active ingredient in antiperspirants. Their second product, which accounted for the remaining 10-15% of the revenue, was an aluminum salt solution which was used in waste water as a flocculant. Both processes began with reacting aluminum ingots with hydrochloric acid (20 degree baume) and water to produce an aluminum chlorohydrate solution. Once they had the aluminum chlorohydrate, it could be mixed with zirconium oxychloride (ZOC) and/or zirconium basic carbonate (ZBC) to produce the aluminum zirconium trichlorohydrate for antiperspirant. Or the aluminum chlorohydrate could be further reacted with sulfuric acid to produce the polyaluminum hydroxychlorosulfate, which was sold as the water treatment flocculant. In addition, sometimes they would mix polyquaternary amine or poly dimethyldiallylammonium chloride into the water treatment product.

The majority of the material for disposal at the site, approximately 160,000 plus gallons, is a wash/rinse water that they generated during production. The material is stored in bulk tanks, totes and drums. Some of this material has the potential to be hazardous for chromium and lead, as well as being corrosive, but the majority is believed to be non hazardous. The work plan calls for bulking the totes into empty storage tanks, and sampling from there. The site also contains bulk tanks of muriatic acid which will need to be sampled, as well as bulk tanks of unused aluminum chlorohydrate solutions.

The site contains three R&D and QC laboratories, and their contents will need to be lab packed for disposal. Also, the basement has a storage room that is full of small QC samples of both finished products and raw materials. The initial plan for this material is to haz-cat for compatibility, and then bulk the small containers into drums for disposal. The warehouse contains drums of both finished and raw product that will require analysis for disposal. And a large quantity of finished and off-spec products, mostly in powder form, that will need to be sampled and bulked into roll-offs for disposal.

This site is located in the City of Middletown, Town of Wallkill, which is in Orange County in the State of New York. The nearest residence is within 0.25 miles to the northeast.

## **1.2 Plant History**

Information gathered at the facility indicates that the facility was shut down in the Fall of 2004. On February 10, 2005, an inspection of the closed site by the Town of Wallkill Assistant Code Enforcement Officer and the Orange County Hazardous Materials Response Team led to a referral to the New York State Department of Environmental Conservation (NYSDEC). Subsequent NYSDEC investigations revealed the on-site storage of various chemical products, off-specification chemicals, chemical intermediaries, and chemical wastes at the Facility. Further investigation revealed that some of these chemicals may have been historically disposed at the site.

## **1.3 Purpose of Investigation**

The objective of the Subsurface Investigation is to characterize the nature and extent of any soil contamination at the Facility from past operations. The investigation will be conducted in two phases (Phase I, and Phase II if necessary) utilizing direct-push sampling methodology at pre-selected locations and depths. Sampling locations and depths will be selected by the EPA On-Scene Coordinator (OSC), and will be based on visual observations (i.e., areas of stressed vegetation) and/or reported historical disposal areas. If nature and extent of soil contamination cannot be adequately determined following review of the sampling analyses, the sampling areas will be expanded and further sampling will be conducted in the expanded areas.

Phase II of the Subsurface Investigation may include additional soil sampling and/or the installation, sampling, and subsequent abandonment of temporary groundwater monitoring wells. These tasks will be conducted if deemed necessary by the EPA OSC after review of the Phase I results.

## **1.4 Scope of Work**

The following outlines the scope of work associated with the Subsurface Investigation at the former Westwood Chemical Corporation.

### **1.4.1 Soil Sampling**

A sampling grid was designed by the EPA OSC, Mr. Dilshad Perera. The grid consists of equilateral triangles, and demarcates sampling locations within the eastern and southern portions of the Facility where soil contamination is suspected. The sampling grid is included as Figure 1-1. Refer to Appendix B of the Quality Assurance Sampling and Analysis Plan (QA/SAP) for further information on systematic grid sampling.

The nodes at the intersection of each triangle represent individual sampling locations, and will be staked and labeled in the field. Phase I soil samples will be collected at the locations specified in Figure 1-2, as determined by the EPA OSC. Samples will first be collected by Earth Tech personnel at two depth intervals (0-3 inches below ground surface (bgs) and 6 inches bgs). Direct-push methodology (e.g., GeoProbe® or similar technology) will then be



**Figure 1-1: Soil Sampling Grid, Former Westwood Chemical Corporation Site**

Figure 1-2: Phase I Soil Sampling Locations

used to collect discrete soil samples at one-foot intervals (i.e., one foot bgs, two feet bgs, etc) until groundwater is encountered. Based on previous information, the groundwater is expected to be encountered at one to six feet bgs. The soil samples will be collected, preserved, and handled as described in the site-specific QA/SAP. The number and locations of Phase II soil samples (if required) will be determined by the EPA OSC after reviewing the Phase I soil sampling results, and will follow the same sampling grid.

Background samples will not be collected at the site during the Subsurface Soil Investigation, per the direction of the EPA OSC. The reason for omitting background samples is the lack of a suitable background sampling location at the site. No hydraulically upgradient, undisturbed areas are evident at the site, and much of the undeveloped land appears to contain fill material. Per the EPA OSC, background samples will be collected by the EPA at a nearby, offsite location similar to the site.

#### 1.4.2 Sample Analyses

The soil samples collected during this investigation (both Phase I and Phase II, if necessary) will be analyzed by Upstate Laboratories, Inc. in Syracuse, NY. Each sample collected will be analyzed for each constituent listed in Table 1-1 below.

Table 1-1  
Soil Sample Analyses

Constituent	Test Method	Number of Samples
Metals*	SW6010B / SW3050A	Approx. 480
Chloride	E325.2	Approx. 480
Sulfate	E375.4	Approx. 480
Soil pH	SW9045D	Approx. 480
Percent Moisture	D2216	Approx. 480

\* - Metals analysis includes: aluminum, arsenic, chromium, lead, magnesium, potassium, selenium, silver, sodium, and zirconium.

Additional analyses may be performed for select samples (e.g., the 0-3 inch bgs samples), at the discretion of the EPA OSC. These analyses may include some or all of the Target Analyte List (TAL) and Target Compound List (TCL) constituents. The TAL constituents include 23 metals and cyanide, the TCL constituents include volatile and semivolatile compounds, pesticides, PCBs, and dioxins/furans. The EPA OSC will notify Earth Tech if any analyses differing from those listed in Table 1-1 are to be performed. Earth Tech will notify the appropriate contact(s) at Upstate Laboratories, Inc.

The applicable groundwater analyses will be determined and specified by the EPA OSC if the installation and sampling of temporary groundwater wells (Phase II) are deemed necessary at the site.

## **2.0 SUMMARY OF EXISTING INFORMATION**

The following sections discuss the environmental setting at the former Westwood Chemical Corporation Site.

### **2.1 Site-Specific Environmental Setting**

Limited regional and site-specific geologic information for the former Westwood site was available during the generation of this Work Plan. The elevation at the site (estimated from 1983 USGS topographic maps at [www.terreserver.microsoft.com](http://www.terreserver.microsoft.com)) is approximately 630 feet above mean sea level (msl). The majority of the property has apparently been developed or shaped, and fill material is assumed to cover most of the land. The general topography of the site slopes gently to the east and south. However, the property is hydraulically upgradient from each of its surrounding parcels, and portions of the property also slope gently to the north and west.

The former Westwood site is bordered on the east by an unnamed tributary to Wallkill River. This tributary receives the majority of the storm water runoff from the property through overland flow and drainage ditches.

### **2.2 Groundwater**

Three monitoring wells have been previously installed in the shallow aquifer beneath the eastern portion of the former Westwood site by NYDEC. Monitoring Well #1 is located in an area of stressed vegetation approximately 13 feet east of the eastern asphalt driveway surrounding the facility. Monitoring Well #2 is located approximately 110 feet east-southeast of Monitoring Well #1. Monitoring Well #3 is located approximately 140 feet north-northeast of Monitoring Well #2, approximately 40 feet southwest of an onsite pad-mounted generator.

Well installation information (e.g., installation dates, construction details, etc.) was unavailable during the generation of this work plan. Well construction details and groundwater levels were obtained by Earth Tech during a May 19, 2005 sampling event. Groundwater levels were also measured on August 4, 2005. A summary of the monitoring well and groundwater details is provided in Table 2-1.

**Table 2-1**  
**Monitoring Well and Groundwater Details**

	Monitoring Well #1		Monitoring Well #2		Monitoring Well #3	
	05/2005	08/2005	05/2005	08/2005	05/2005	08/2005
Top of Well Casing to Ground Surface	3.25 ft.	3.25 ft.	2.42 ft.	2.42 ft.	3.75 ft.	3.75 ft.
Top of Well Casing to Top of Groundwater	6.31 ft.	6.89 ft.	3.1 ft.	7.29 ft.	5.17 ft.	7.27 ft.
Groundwater Level (bgs, calculated)	3.06 ft. bgs	3.64 ft. bgs	0.68 ft. bgs	4.87 ft. bgs	1.42 ft. bgs	3.52 ft. bgs

Table 2-1 presents the groundwater levels as depth below the immediate ground surface. However, the eastern portion of the site slopes toward the drainage ditch and unnamed tributary along the east and northeast borders of the site.

In August 2005, a surveying company marked the property boundaries at the site. During these activities, the surveyor measured the elevations of the groundwater wells relative to a known benchmark near the site. The elevations of the top of casings, relative to the benchmark, are presented in Table 2-2. These elevations were used to calculate the relative groundwater elevations at the site after adjusting to the ground surface level of Monitoring Well #1

**Table 2-2**  
**Relative Groundwater Elevations**

	Monitoring Well #1		Monitoring Well #2		Monitoring Well #3	
	05/2005	08/2005	05/2005	08/2005	05/2005	08/2005
Top of Well Casing Elevations, Relative to Benchmark	--	102.05 ft	--	99.76 ft	--	98.28 ft
Difference in Casing Elevation, Relative to Monitoring Well #1	--	--	--	-2.29 ft	--	-3.37 ft

**Table 2-2**  
**Relative Groundwater Elevations**

	Monitoring Well #1		Monitoring Well #2		Monitoring Well #3	
	05/2005	08/2005	05/2005	08/2005	05/2005	08/2005
Top of Well Casing to Ground Surface	3.25 ft.	3.25 ft	2.42 ft.	2.42 ft.	3.75 ft.	3.75 ft.
Difference in Well Casing Height, Relative to Monitoring Well #1	--	--	--	-0.83 ft	--	+0.5
Total Difference in Elevation, Relative to Monitoring Well #1 <sup>(a)</sup>	--	--	--	-1.46 ft	--	-4.27 ft
Groundwater Levels (from Table 2-1)	3.06 ft. bgs	3.64 ft. bgs	0.68 ft. bgs	4.87 ft. bgs	1.42 ft. bgs	3.52 ft. bgs
Calculated Groundwater Levels, Relative to Monitoring Well #1 <sup>(b)</sup>	3.06 ft. bgs	3.64 ft. bgs	2.14 ft. bgs of MW #1	6.33 ft. bgs of MW #1	5.69 ft. bgs of MW #1	7.79 ft. bgs of MW #1

<sup>(a)</sup> - Total difference in Elevation was calculated by subtracting the difference in well casing height from the relative elevations for Monitoring Wells #2 and #3 (relative to Monitoring Well #1).

<sup>(b)</sup> - Groundwater Levels were calculated by subtracting the total difference in elevation from the observed groundwater levels at Monitoring Wells #2 and #3. Units are reported as feet below the ground surface of Monitoring Well #1.

With the exception of the May 2005 measurement at Monitoring Well #2, the relative groundwater elevations are highest near Monitoring Well #1, suggesting that groundwater flow is to the east and north (toward the unnamed tributary to Wallkill River). However, no evidence of a hydraulic connection to the tributary or the drainage ditch was observed during an August 4, 2005 walk-through. It is unknown at this time whether the groundwater beneath site exists in an isolated, perched aquifer or as part of a larger, flowing system.

### **3.0 PROJECT TASKS**

The following sections briefly describe the proposed project tasks to be performed under this Work Plan.

#### **3.1 SUBSURFACE INVESTIGATION**

##### **3.1.1 Direct-Push Soil Sampling**

Direct-push sampling will be utilized for the collection of soil and groundwater samples. All sampling locations will be outdoors in earthen or asphalt-covered areas. Earth Tech will be responsible for coring the asphalt-covered sampling areas prior to direct-push sampling. A discussion of the direct-push sampling procedures to be used for both Phase I and Phase II (if necessary) sampling, borehole abandonment, and equipment decontamination is provided below.

##### **3.1.1.1 Sampling Procedures**

Two soil samples will be collected at each pre-selected sampling location (zero to three inches bgs and six inches bgs) by Earth Tech personnel using a stainless steel spoon or trowel. All sampling equipment will be thoroughly decontaminated before and after each sample is collected, per the procedures outlined in the site-specific QA/SAP.

Up to five additional samples will be collected at each location by mechanically advancing a stainless steel direct-push sampler vertically into the ground using a GeoProbe® or similar rig. These additional soil samples will be discrete samples, collected by the Contractor at one-foot intervals at each borehole location. Sampling will begin at the one-foot bgs interval and continue until groundwater is encountered, or until Earth Tech personnel direct the Contractor to cease sampling. The groundwater elevations at the site vary, but are estimated to be from one to six feet bgs. No samples are anticipated to be required at depths greater than six feet bgs.

Each stainless steel sampler will contain a new, non-reactive (acetate) liner. After the sampler has been advanced through the desired soil sampling interval, the sampler will be removed from the hole and the soil core will be removed from the sampler. The portion of the soil corresponding to each sampling interval will be transferred into the appropriate, laboratory-provided sample containers. The samples will be affixed with a completed sample label, placed in a plastic bag, and placed in an iced cooler. All samples will be collected, preserved, transported, and shipped per the requirements of the site-specific QA/SAP.

##### **3.1.1.2 Abandonment**

All holes created during manual and direct-push sampling will be abandoned by removing all equipment from the hole and backfilling the hole with 100-percent sodium bentonite chips. The bentonite shall be emplaced from the bottom to the top of the hole and subsequently hydrated to ensure an adequate seal. At locations where asphalt surfaces have been cored, the core will be replaced and the ground surface will be patched with like materials.

### **3.1.2 Direct-Push Groundwater Sampling**

Installation, development, sampling, and abandonment of temporary groundwater monitoring wells may be performed under Phase II of the Subsurface Investigation. The general procedures and requirements of these tasks are presented in Section 4.2.2 of the SOW.

### **3.1.3 Equipment Decontamination**

All equipment that may directly or indirectly contact samples shall be decontaminated in a designated decontamination area. Equipment decontamination shall be conducted per the requirements of the site-specific QA/SAP (Appendix D – Field Decontamination Procedures). This includes direct-push rods, the portions of rig that stand above the boreholes, sampling devices, and any ancillary equipment. In addition, the contractor shall take care to prevent the sample from coming into contact with potentially contaminating substances, such as tape, oil, engine exhaust, corroded surfaces, and dirt.

### **3.1.4 Waste Handling**

#### **3.1.5 General Waste Handling Procedures**

Waste handling shall be dealt with on a site-by-site basis. Waste may be classified as noninvestigative waste or investigative waste.

Noninvestigative waste, such as unsoiled personal protective equipment, litter, and household garbage, shall be collected on an as-needed basis to maintain each site in a clean and orderly manner. This waste shall be containerized and transported to the Earth Tech-designated waste receptacle or collection area. Acceptable containers shall be sealed boxes or plastic garbage bags.

Investigation derived waste (IDW) such as impacted, disposable personal protective equipment; any soil sampling remains or waste; well development and purge waters, and spent decontamination fluids generated during the investigation will be contained separately in 55-gallon drums. The IDW will be sampled and analyzed to determine its waste characteristics. The waste disposal subcontractor will comply with all applicable State and Federal regulations.



#### **4.0 DATA ASSESSMENT, RECORDS, AND REPORTING REQUIREMENTS**

The following sections describe data assessment, record keeping, and reporting requirements for the soil and/or groundwater investigation activities to be conducted at the former Westwood Chemical Corporation.

##### **4.1 Data Assessment**

Data collected during the investigation will generally consist of field and analytical data. Data assessment methods will vary depending on the type of data collected. Data will be analyzed to ensure that accurate and valid data have been generated. The data will then be used to define the nature and extent of contamination at the site and prepare remediation plans.

The process of generating analytical data of known quality begins in the planning stages when data quality objectives are established, continues during sample collection activities and laboratory analysis, and is completed by reviewing the analytical data. Data will be reviewed and/or validated per the requirements of the site-specific QA/SOP. Data qualifiers will be used to indicate data validity and potential limitations of data usage when QA/QC criteria are not met.

##### **4.2 Record Keeping**

Field records will be maintained to recreate all sampling and measurement activities. The requirements listed in this section apply to all measuring and sampling activities. The information will be recorded with indelible ink in a permanently bound notebook with sequentially numbered pages. These records will be archived in an easily accessible form and made available to the EPA upon request.

The following information will be recorded for all field activities: (1) location, (2) date and time, (3) identity of people performing activity, and (4) weather conditions. The following additional information will be recorded for all sampling activities: (1) sample type and sampling method, (2) the identity of each sample and depth from which it was collected, (3) the amount of each sample, (4) sample description (e.g., color, odor, clarity), (5) identification of sampling devices, and (6) identification of conditions that might affect the representativeness of a sample. Monitoring well information will also include construction details, development information, and stabilization parameter measurements during purging and sampling.

##### **4.3 Reporting Requirements**

After completion of field activities, a Subsurface Sampling Report will be submitted to the EPA. The report will contain the analytical results of the sampling, a discussion of the results, and recommendations for further action, if needed.

## **5.0 PROJECT SCHEDULE**

The work proposed in Phase I of this Work Plan is anticipated to begin in September 2005. The exact schedule for the Phase I activities will be finalized at a later date. Phase II work will be performed as soon as possible, following notification that the additional work will be required at the site.

SOP No: 09  
Rev #: 01  
Date: 04/98  
Page: 3 of 20  
Revised: 09/03

**STANDARD OPERATING PROCEDURE (SOP)**  
**Field Characterization Testing**

Prepared by: \_\_\_\_\_  
Ann-Alyssa King, Chemist

Date: \_\_\_\_\_

Reviewed by: \_\_\_\_\_  
Mark Kromis, QA/QC Officer

Date: \_\_\_\_\_

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## 1.0 INTRODUCTION

This manual presents Earth Tech's Field Characterization Testing Standard Operating Procedures (SOPs) to be utilized during on-site screening of unknowns. The manual details a series of semi-quantitative and qualitative tests designed to identify physical and chemical characteristics of waste so that they may be classified by hazard categories. These characteristics are then used to determine the proper handling and disposal of the waste.

The objectives of field characterization testing are to identify materials which require special safety handling procedures and to minimize the transportation and disposal (T&D) cost of the waste disposal through on-site waste consolidation. Quantitative analysis will be required for disposal of wastes from the site and is very costly. Cost savings is achieved by performing a series of semi-quantitative and qualitative tests (field characterization). From this data, the Earth Tech chemist can develop a compositing scheme so that multiple containers bearing similar characteristics can be analyzed as a single sample as a result of successful composite testing. This results in a significant reduction of analytical costs in comparison to testing each container individually.

## 2.0 FIELD CHARACTERIZATION TESTING

The Earth Tech field characterization scheme is designed to identify the following waste properties:

<input type="checkbox"/> shock sensitive	<input type="checkbox"/> biological hazards
<input type="checkbox"/> radioactive	<input type="checkbox"/> air reactive
<input type="checkbox"/> water reactive	<input type="checkbox"/> organic
<input type="checkbox"/> aqueous	<input type="checkbox"/> acid/base
<input type="checkbox"/> organic peroxide	<input type="checkbox"/> oxidizer
<input type="checkbox"/> sulfide	<input type="checkbox"/> cyanide
<input type="checkbox"/> halogenated organic	<input type="checkbox"/> flammable

At the completion of the testing the containerized waste materials are separated into "compatible" groups. This task is performed using the Earth Tech Waste Tracking System (WTS) which will aid field personnel with data management. Each container and/or layer in a container is then placed into a waste stream by the Chemist, Response Manager (RM), Project Manager, and the T&D Coordinator.

Once the waste streams have been determined, a bench scale bulking test is performed on each group. This test is designed to ensure no unforeseen reactions will occur during the field blending of wastes. A representative composite must be created for each waste stream for analysis and possibly for disposal facility approval. Bulk testing confirms that materials are truly compatible and ensures against reactions in the composite samples to be shipped to the laboratory.

A waste stream is comprised of all wastes with the same hazardous, chemical, and/or physical characteristics, and which are compatible and will be treated with the same disposal method. Field testing methods have been developed to easily obtain information on a sample which will assist in arriving at a determination as to whether a waste is hazardous or not. All samples with the same results from the field testing are most likely physically and chemically compatible.

An additional test of sample compatibility should be made by mixing together small quantities of separate samples and observing any reaction. If any type of physical or chemical reaction such as fuming, heat generation, or chemical precipitation occurs during the mixing operation, the samples are not considered compatible and must not be combined. All samples that have the same test results and are compatible will most likely be treated with the same method of disposal. The field testing methods used to make site waste stream determinations are referred to as field characterization testing.

The Field Chemist will be responsible for performing the test procedures on each sample and will document the results of each test electronically using the Earth Tech bar coding or manually on the Drum/Container Inventory Log. Information will ultimately be transferred to the WTS. Any observations of unusual test results will be recorded. If any tests are not performed, this will be documented so that no information is perceived to be missing. Furthermore, any additional tests that are performed for more specific characterization of the samples will be documented with the results.

Following are the field characterization testing procedures to be followed for determining waste streams in the field, and a list of the materials required to perform each test.

## **2.1 Visual Survey**

Upon receipt of the samples in the field laboratory, the sample custodian will open the shipping containers and unpack the contents. Each sample will be visually examined for specific physical characteristics as detailed in this section.

### **General Sample Inspection**

For each sample, the sample custodian will note the following:

- physical state of each layer
- determination of sample colors for each layer
- determination of sample clarity for each layer
- integrity of sample jars
- number and size of sample jars per drum
- confirmation that sample matches physical description given on Container Inventory Log

If any samples are broken or depleted due to leakage, missing, or if discrepancies in the physical description or any other questionable observation is noted, then the Project Chemist should be promptly notified. If the sample passes the general inspection, then the sample custodian will record the results of this survey and accept custody of the sample.

## **Biological Survey**

An important part of the visual survey for the sample log is the biological survey. This is performed prior to the radiological survey and concurrently with the general sample inspection. The contents of the unopened containers will be inspected for evidence of biological materials such as hypodermic syringes, medical gauze, Petri dishes, cultures, blood, or animal tissues.

If biological material is discovered, immediate notification will be made to the Site Supervisor, Project Manager, and Site Health and Safety Officer. The sample jar should not be opened and no further compatibility testing should be performed.

## **2.2 Radiological Survey**

If the sample has passed both the general and biological surveys, the sample will be surveyed for radiation.

### **Scope and Application**

There are three types of radiation that may be encountered in the field:

- Alpha Radiation is a type of particle radiation easily stopped by material such as clothing, paper, or glass. While alpha radiation is the least penetrating type, it can be very dangerous if ingested, inhaled, or if it enters the body through a puncture wound or laceration.
- Beta Radiation is another type of particle radiation more penetrating than alpha radiation, but cannot pass through material such as steel. Exposure to beta radiation may cause skin burns, and beta rays are harmful if they enter the body.
- Gamma Radiation (x-rays), unlike alpha or beta radiation, is electromagnetic in nature and intensely high in energy. Gamma rays are extremely penetrating and are best absorbed by dense material like lead and depleted uranium. Exposure to gamma rays may be lethal; complete protection is essential.

The type of radiation detected depends upon the probe being used. The metal bodied probe with a side window and sliding cover detects beta and gamma radiation. When the window is closed, beta radiation is shut out and only gamma radiation is detected. The probe with the end window detects alpha, beta, and gamma radiation. The newer pancake-style probe will also detect alpha, beta, and gamma radiation.

The survey meter that is used measures the radiation in millirem per hour (mR/hr). This is a dose measurement equivalent to the hours of exposure multiplied by the average measured level of exposure, which is obtained by the use of a personal dosimeter or by a film badge. The following are accepted terms used to describe radiation levels:

- **Background Radiation**--The normal amount of naturally occurring radiation that exists without cause for alarm 9between 0.008 and 0.02 mR/hr).
- **Radiation Area**--Defined by the Nuclear Regulatory Commission (NRC) as an area in which there are 2 mR/hr or greater present or an area where one can accumulate 100 mR of exposure in 5 days of normal work in the area.
- **High Radiation Area**--Defined by the NRC as an area with radiation greater than 100 mR/hr.

#### Safety Considerations

When handling possible radioactive samples, the following precautions should be used:

- Limit the time spent handling radioactive material.
- Control spread of radioactive contamination.
- Put as much distance and protective equipment (i.e., lead shield) as possible between yourself and the radioactive material.
- If a sample is determined to be radioactive, the sample will be sealed and removed from the laboratory. No further compatibility testing is required. The Project Chemist, Project Manager, and/or Site Supervisor, and the Site Health and Safety Officer will be promptly notified. The Project Chemist will then shield and secure the sample in the most appropriate manner (e.g., if gamma radiation is present, then the sample might be placed in a lead container and labeled "Radioactive Waste").

#### Method

The probe of the dosimeter is held approximately 2 inches from the unopened sample jar. It is not uncommon for the dosimeter reading to briefly jump above background, but not stay there. If this occurs do not be alarmed; this is not a positive reading for radiation.

If sustained elevated readings (greater than 0.2 mR/hr) occur, the sample will be secured and the Project Chemist, Project Manager, and/or Site Supervisor, and the Site Health and Safety Officer will be immediately notified. The sample will then be handled according to the type of radiation present and to the satisfaction of Earth Tech's health and safety department and the client.

If the readings are background or below, the lid of the sample jar is removed and the sample is again surveyed. Readings will be taken for all types of radiation, which will require the use of more than one probe or the use of the more sensitive pancake probe. Radiation survey results are recorded on the Drum/Container Inventory Log as each sample is surveyed.



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### Interference

If at least one of the samples is found to be radioactive, the work area and the person conducting the survey should be screened for radioactivity using the dosimeter. Be sure to survey the floor and the person's shoes for the presence of radiation.

Even if no radiation is detected on the person or in the work area, decontamination procedures should still be implemented. First, decontaminate the work area by changing the bench paper, wiping down surrounding surfaces with soap and water, and sweeping. Then perform personal decontamination by removing and discarding protective clothing and washing hands and face.

Occasionally, interference in background readings will occur to sun spot activity.

## **2.2 Sample Reactivity**

Each layer of every sample is tested for its reactivity with air and water. The testing procedures are detailed in the following subsections.

### Air Reactivity

Any sample that emits vapor, changes physical state, or ignites spontaneously in the presence of air is defined as air reactive.

### Scope and Application

The objective of this test is to determine whether the sample is reactive upon exposure to air, thus requiring special care in handling of the sample and giving warning to site personnel that the container requires separation and special handling.

### Method Summary

Each sample is checked for its reactivity with air by placing approximately 0.5 milliliter (ml) of liquid or ½ gram (g) of solid onto a spot plate and warming to approximately 120 degrees Fahrenheit (49 degrees Celsius).

Observe the sample for two minutes. If visible vapors are released, if fire or deflagration occurs, or the sample dramatically and permanently changes physical state, the sample is air reactive.

**CAUTION: AIR REACTIVE SAMPLES SHOULD BE IMMEDIATELY REMOVED FROM THE WORK AREA BY THE PROJECT CHEMIST AND STORED IN A REMOTE, SECURE PLACE.**

If the sample is air reactive, no further testing should be done unless authorized by the Project Chemist. All observations and results are recorded in the appropriate section of the Drum/Container Inventory Log. All pertinent personnel are then notified. No known interference exists for this procedure.

### Safety Considerations

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If a sample is determined to be air reactive, promptly notify the Project Chemist, Project Manager and/or Site Supervisor, and the Site Health and Safety Officer. The Project Chemist will put the sample under a nitrogen or helium atmosphere and remove it from the laboratory. The sample may additionally be placed into a polyethylene bag that previously has been purged with nitrogen.

#### Water Reactivity

Any sample that generates excessive heat, emits fumes, explodes, changes physical state or spontaneously ignites upon contact with water is defined as water reactive.

#### Scope and Application

The objective of this test is to determine whether the sample is reactive upon exposure to moisture or water, thus requiring special care in handling the sample and giving warning to site personnel that the container requires separation and special handling.

#### Method Summary

Each layer of every sample that was found not to be air reactive is checked for its reactivity with water. This is performed as the initial part of the water solubility test detailed in the next section.

#### Safety Considerations

If a sample is determined to be water reactive, it will be sealed in a plastic bag that has been previously purged with nitrogen or helium, removed from the laboratory, and placed in a secure, dry storage area. Prompt notification must be given to the Project Chemist, Project Manager, and/or Site Supervisor, and the Site Health and Safety Officer.

If the sample is water reactive, the pH of the water solution is taken and recorded in the proper section of the Drum/Container Inventory Log. No further testing should be done unless authorized by the Project Chemist. All pertinent personnel are then notified.

#### Interferences

Air trapped in finely divided solids can give the appearance of gas evolution. Strong acids and bases may cause the water to heat up and steam or boil. This should be noted in the "Comments" section of the Drum/Container Inventory Log and considered when classifying the drum for waste blending.

### **2.3 Water Solubility and Density**

Each layer of every sample is tested for its solubility in water and a 1:1 hexane/dichloromethane (DCM) mixture. The procedures are detailed in the following subsections.

#### Scope and Application

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The objective of this test is to determine if a sample layer is or is not aqueous, whether it has a density less than or greater than that of water (1.0 g/ml), and the polarity of organic and inorganic material.

#### Method Summary

Each layer of every sample is checked for water solubility by cautiously placing a small portion into a culture tube containing distilled water. The sample is thoroughly mixed and observations are made of the material's solubility and whether insoluble or partially soluble materials float or sink. Results are documented as to whether the sample is soluble (S), insoluble (I), or partially soluble (PS). Density is recorded as heavier (H) than water or lighter (L) than water.

Note any reaction with the water, such as fuming or boiling. Dissolving indicates the substance is a water-soluble inorganic or polar organic substance (such as salts or alcohols). Emulsification indicates a slightly polar organic (such as a pesticide). Floating of liquids indicates a non-halogenated, non-polar organic substance (such as an alkane like hexane). Sinking of liquids indicates a halogenated non-polar organic (such as carbon tetrachloride or trichloroethene). White curdling is typical of a liquid plastic resin. Fuming and/or a temperature changes are typical of acids or bases (see corrosivity test).

#### Safety Considerations

Extra caution should be used around samples which emit visible vapors, as they may be water reactive. Always add an unknown substance to water, never the opposite.

#### Interference

Most low-molecular-weight, polar, organic compounds (such as alcohols), are water soluble but are not considered an aqueous liquid. If the sample is soluble in both water and in a hexane/DCM mixture, the sample should be classified as an organic.

### **2.4 pH**

The pH test is to be performed on all samples whether or not they appear to be soluble in water. Samples that are apparently insoluble in water, yet have a pH of less than 2 or greater than 12, are actually partially soluble in water.

#### Scope and Application

The objective of this test is to determine if the sample is an acid (pH 2 or less) or basic (pH 12 or greater).

#### Method Summary

The pH of the sample is approximated using pH indicator strips or pH test strips.

### **2.5 Hexane/DCM (1:1) Solubility**

Each layer of every sample will be tested for solubility in a 1:1 (v:v) hexane/DCM mixture.

#### Scope and Application

The objective of this test is to determine if the sample is inorganic or organic in nature.

#### Method Summary

A small portion of the sample is placed into a culture tube containing the hexane/DCM mixture. The sample is thoroughly mixed and its solubility is recorded on the Drum/Container Inventory Log.

#### Safety Considerations

The hexane/DCM mixture is flammable and should be used away from any ignition source. DCM has significant health effects for people with heart problems and its material safety data sheets (MSDS) should be reviewed by all personnel before handling.

#### Method

- One-to-one (v:v) mixture of hexane and DCM.
- Cautiously place a small sample aliquot (1-ml or 1-g) into a culture tube containing approximately 1 ml of a 1:1 hexane/DCM mixture.
- Observe the sample's solubility in the hexane/DCM mixture and record the solubility on the Drum/Container Inventory Log as either S (soluble), PS (partially soluble) or I (insoluble).

#### Interference

Some highly polar, organic substances may not be soluble in a hexane/DCM mixture, and therefore would be classified as inorganic. If the sample is a solid insoluble in both water and a hexane/DCM mixture, but exhibits a positive flashpoint test, the sample should be treated as an organic. If the sample is a liquid and insoluble in both water and a hexane/DCM mixture, the sample should be treated as an organic. Solubility can also be further checked with a more polar solvent, such as ethyl acetate.

### **2.6 Oxidizing Potential**

Test strips are used for the qualitative determination of the presence of oxidizers in each layer of every sample.

#### Scope and Application

The objective of this test is to determine the presence of strong oxidizing agents such as chlorine and chlorine dioxide. The results are used to identify wastes that may react violently with organic wastes. This test should be performed on undiluted aqueous samples or aqueous sample extracts.

#### Method Summary

A drop of aqueous sample or the aqueous sample extract is placed on a potassium iodide starch test paper which has been previously moistened with glacial acetic acid. A resultant blue to black color on the test paper indicates the possible presence of an oxidizer. For dark colored samples, test with a potassium iodide solution along with a soluble starch solution instead of the test paper.

#### Safety Considerations

Samples testing positive for oxidizers should be segregated from organic samples and the Site Supervisor should be notified that the same should be done to the corresponding waste containers.

#### Quality Assurance/Quality Control (QA/QC)

At the start of every shift or when a new tube of potassium iodide starch indicator papers is opened, check the papers by testing them with a 0.03% solution of hydrogen peroxide. Record the results on the back of the first Drum/Container Inventory Log of that shift. Always remember to date and initial QC checks. If you cannot obtain a positive test result, immediately notify the Project Chemist.

### **2.7 Peroxide**

Test strips are used for the semi-quantitative determination of the presence of peroxides in each layer of every sample.

#### Scope and Application

The objective of this test is to determine the presence and approximate concentration of organic peroxides in waste samples. The presence of organic peroxides in concentrations greater than 5,000 parts per million (ppm) in a waste sample indicate that the sample and the container represented by the sample are potentially shock sensitive.

#### Method Summary

Peroxidase transfers peroxide oxygen into an organic redox indicator which is thereby converted into a blue oxidation product. The moisture required for checking the hexane/DCM sample extract is obtained by placing a drop of distilled water into the reaction zone after immersion in the solvent. The method will work in either aqueous or organic liquids.

**NOTE: KEEP PEROXIDE STRIPS TIGHTLY SEALED AND REFRIGERATED WHEN NOT IN USE. DO NOT USE TEST STRIPS PAST THEIR EXPIRATION DATE.**

#### Safety Considerations

If the result of an organic sample is greater than 5,000 ppm (0.5 percent), then the sample should be considered shock sensitive.

The Project Chemist, Site Supervisor, and Site Health and Safety Officer must be notified immediately. Properly trained personnel should remove the sample from the laboratory area before work resumes on the remaining samples.

### Interference

A green to blue color of the reaction zone is produced at pH 5 to 6 in cases where there is greater than:

- 5 milligrams per liter (mg/L) gold (Au)<sup>3+</sup>
- 5 mg/L cesium (Ce)<sup>+</sup>
- 250 mg/L mercury (Hg)<sup>2+</sup>
- 10 mg/L chromate (CrO<sub>4</sub>)<sup>2-</sup>
- 10 mg/L ferric cyanide complex [Fe(CN)<sub>6</sub>]<sup>3-</sup>
- 40 mg/L iodate (IO<sub>3</sub>)<sup>-</sup>
- 2 mg/L permanganate (MnO<sub>4</sub>)<sup>-</sup>
- 20 mg/L persulfate (S<sub>2</sub>O<sub>8</sub>)<sup>2-</sup>
- 5 mg/L metavanadate (VO<sub>3</sub>)<sup>-</sup>

If interference is suspected, implement proper procedures to eliminate the interference.

### Quality Assurance/Quality Control

At the start of every shift or when a new tube of peroxide test strips is opened, check the strips by testing them in a 0.01 percent hydrogen peroxide solution and with distilled water. Record the results on the back of the first Drum/Container Inventory Log of that shift. Always remember to date and initial QC checks. If you cannot obtain a positive test result with the hydrogen peroxide solution or a negative result with the distilled water, immediately notify the Project Chemist.

## **2.8 Halogen (Beilstein) Test**

The Beilstein flame test for the presence of halogens in liquid and solid phase samples is detailed in this section.

### Scope and Application

The objective of this test is to determine the presence of 1 percent or greater concentration of halogenated organic compounds in a sample. If the test is positive, special care must be used in screening the samples for polychlorinated biphenyls (PCBs). If the test is positive, further tests may be required as per the request of the client or of the T&D Coordinator to determine the halogenated compound that is present.

### Method Summary

A small portion of the sample is burned on a copper wire in a flame and the color of the flame is observed. The appearance of a green flame indicates the presence of at least 1 percent of a chlorinated compound in the sample. A blue flame indicates the presence of a brominated compound and a purple flame indicates the presence of an iodinated compound.

### Safety Considerations

When using an open flame in any laboratory, make sure there are no flammable solvents or samples in your work area. Check the condition and location of your fire extinguisher and have a

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plan to handle an uncontrolled fire. Ideally, the torch should be taped down to the surface on which it rests or held by a clamp on a ring stand.

#### Method

Copper wire, 18-gauge or smaller (purchase locally): obtain a piece of copper wire approximately 6 inches in length. Make a small loop at the end of the wire the size of a pea.

Clean the copper wire loop and twists by holding in a flame from a propane torch until the wire glows orange. Cool by submerging the wire in a beaker of clean distilled water.

NOTE: DO NOT USE COPPER TUBING; MATERIAL ON THE INSIDE WILL NOT BURN CLEAN AND CARRYOVER WILL OCCUR.

WARNING: IF A HOT WIRE IS INTRODUCED INTO A SAMPLE, AN EXPLOSION OR DEFRAGRATION MAY OCCUR.

Retrieve some of the sample on the cooled, looped end of the copper wire.

Place the sample on the loop in the flame from a propane torch and observe the color of the flame from the sample. Hold the loop in the flame until the wire glows orange to clean the loop for the next sample to be tested.

The appearance of a green/blue/purple flame indicates the presence of halogens and a positive Bielsstein result. Any other color observed in the flame is a negative Bielsstein result, but the color of the flame should be noted in the comments section of the Drum/Container Inventory Log.

#### Interference

A false negative result may occur due to very volatile compounds that evaporate completely before they can be heated sufficiently to cause decomposition. False positives may occur on acidic compounds, quinoline and pyridine derivatives, organic acids, urea, and copper cyanide.

#### Quality Assurance/Quality Control

At the start of every shift, check the wire by testing it with a 1:1 hexane/DCM mixture to ensure a green flame is produced when heated. Also check the wire with distilled water for carryover and record the results on the back of the first Drum/Container Inventory Log of that shift. Always remember to date and initial QC checks. If you cannot obtain a positive test result with the hexane/DCM mixture or a negative result with the distilled water, immediately notify the Project Chemist.

## **2.9 Reactive Sulfide**

The test for the presence of sulfides in liquid and solid phase samples is detailed in this section.

#### Scope and Application

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The objective of this test is to quickly determine the presence of sulfides in waste materials. If sulfides are present, they may cause interferences with other analyses, create a hazard during sample handling and field waste blending operations, and may be of special concern for disposal.

#### Method Summary

One drop of the aqueous sample or aqueous sample extract is placed on a lead acetate test paper previously moistened with a sodium acetate buffer solution. The presence of sulfides is indicated by a darkening of the test paper. The method detection limit is 4 mg/L.

#### Safety Considerations

A hydrogen sulfide gas/hydrogen cyanide gas alarm (Monitox) unit should be placed in the hood to detect the presence of hydrogen sulfide gas. Samples that test positive for sulfide should be segregated from acidic samples and the Site Supervisor should be notified that the same should be done to the corresponding waste containers.

**WARNING:** HYDROGEN SULFIDE GAS IS EXTREMELY TOXIC. IF HYDROGEN SULFIDE GAS IS SUSPECTED IN THE WORK AREA, LEAVE THE PREMISES IMMEDIATELY. IF THE "ROTTEN EGG" SMELL OF HYDROGEN SULFIDE IS DETECTED BY ANYONE, EVEN IN THE ABSENCE OF THE HYDROGEN SULFIDE GAS MONITOX ALARM, VACATE THE PREMISES.

#### Method

- Place a strip of lead acetate paper in one spot of the spot plate.
- Moisten the paper with two or three drops of acetate buffer.
- Transfer one drop of the aqueous sample extract or the aqueous sample onto the test paper.
- A darkening of the test paper indicates the possible presence of sulfide.

An alternate method to verify the presence of sulfides is to add three drops of saturated cadmium carbonate solution to 1 ml of the aqueous sample extract or the aqueous sample. Mix the sample thoroughly and observe. The appearance of a yellow precipitate confirms the presence of sulfides in the sample. Record the result on the Drum/Container Inventory Log.

Take care in segregating this waste so as not to contaminate multiple waste streams with cadmium.

#### Interference

Very dark colored samples may make it nearly impossible to detect the darkening of the lead acetate test paper. In this case, use the cadmium carbonate spot test method.

#### Quality Assurance/Quality Control



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At the start of every shift or when a new tube of lead acetate test papers is opened, check the papers by testing them with a 10 mg/L sodium sulfide standard solution and with distilled water. Record the results on the back of the first Drum/Container Inventory Log of that shift. Always remember to date and initial your QC checks. If you cannot obtain a positive test result with the sulfide standard solution or a negative result with the distilled water, immediately notify the Project Chemist.

## **2.10 Reactive Cyanides**

Each layer of every sample is tested for the presence of cyanide. The cyanide spot test procedure is detailed in this section.

### **Scope and Application**

The objective of this test is to quickly determine the presence of cyanide in most forms in a sample. If cyanide is present, precautions must be taken to ensure that acidification of the sample does not occur. The positive sample's corresponding container will require special handling and disposal.

### **Method Summary**

Cyanide is reacted with chloramine-T in a buffered solution to produce cyanogen chloride. The cyanogen chloride is then reacted with pyridine-barbituric acid to form a distinctive red to purple color. When a sample is treated in this manner, the appearance of the red color indicates the presence of cyanide in the sample at a minimum of 1 ppm.

### **Safety Considerations**

A hydrogen sulfide gas/hydrogen cyanide gas alarm (Monitox) unit should be placed in the hood to detect the presence of hydrogen cyanide gas.

**WARNING:** HYDROGEN CYANIDE GAS IS EXTREMELY TOXIC. IF HYDROGEN CYANIDE GAS IS SUSPECTED OUTSIDE OF THE HOOD, LEAVE THE PREMISES IMMEDIATELY. MOST PEOPLE, BUT NOT ALL, CAN DETECT THE ALMOND/AMARETTO-LIKE SMELL OF CYANIDE, AND IF SOMEONE DETECTS THIS ODOR, EVEN IN THE ABSENCE OF THE MONITOX ALARM, VACATE THE PREMISES.

### **Method No. 1**

In a separate test tube, mix iron citrate (about ¼ of the test tube) and a pinch of ferrous ammonium sulfide. Add the unknown liquid sample to the test tube to bring the total volume of the test tube to ½ to ¾ full. Shake the mixture for one minute. Slowly add five to six drops of 3N HCl. A dark Prussian blue color indicates cyanides.

#### Method No. 2

Add ½ ml of phosphate buffer to 1 ml (or 1 g) of the sample in a culture tube. Securely cap and vortex. Check the resultant pH. If the pH is greater than 8, continue adding buffer until a pH of approximately 8 is obtained.

- Add 1 ml of chloramine-T reagent.
- Add 1 ml of pyridine-barbituric acid reagent.
- Allow eight minutes for full color development.
- The appearance of a pink to red color indicates the possible presence of 1 mg/L or more of cyanide.
- If the result is negative, record the result on the Drum/Container Inventory Log. If the result is positive, confirm the result with a Draeger tube.

#### Interference For Method No. 2

Thiocyanates produce a positive result in the cyanide spot test. If thiocyanates are suspected, an aliquot of the sample should be re-tested after formaldehyde is added to remove the cyanide. If the result of the re-testing has the same intensity of red color as the initial cyanide test, then the cyanide test is a false positive due to thiocyanate interference.

Nitrates may also cause a false positive result in the cyanide spot test, except that the color change is to blue or purple. If nitrates are suspected, the sample should be screened for nitrates by the method described in Section 6.0.

A false negative result may occur in the spot test in the presence of a highly reduced sample. Chloramine-T is consumed by the reducing agent, thus requiring additional chloramine-T to react with the sample cyanide.

A false negative also occurs in the spot test in the presence of 0.5 mg/L or more of aldehydes. Aldehydes convert detectable cyanide to non-detectable cyanohydrin.

#### Method No. 3

Semi-quantitative analysis can be performed using an EM Quant Cyanide test kit. The reaction process is similar to that of Method No. 2, but there is no need for reagent preparation.

#### Quality Assurance/Quality Control

At the start of every shift or when new reagents are prepared, check the cyanide spot test with the sodium cyanide standard and with distilled water. Record the results on the back of the first Drum/Container Inventory Log of that shift. Always remember to date and initial QC checks. If you cannot obtain a positive test result with the cyanide standard solution or a negative result with the distilled water, immediately notify the Project Chemist. Additionally, if the Draeger

tube test is required, test the response of the Draeger tube using the cyanide standard in place of the sample.

## **2.11 Flammability**

A flammability test is performed on each layer of every sample.

### Scope and Application

The objective of this test is to determine the flammability of the sample and proper handling and disposal procedures necessary for the container represented by that sample.

### Method Summary

A flammability test is performed by ignition of a small amount of sample. Depending on the method used, the test can provide information which will aid in the Department of Transportation (DOT) classification of the waste.

### Safety Considerations

When using an open flame in any laboratory make sure there are no flammable solvents or samples in your work area. Check the condition and location of your fire extinguisher(s) and have a plan in the case of an uncontrolled fire.

### Method No. 1

Place a pea-sized amount of unknown solid or a quarter-sized pool of unknown liquid onto a watch glass. Touch a lighted match to the surface of the unknown substance.

If the match goes out and the unknown substance does not burn, the unknown is not ignitable. If the flame jumps from the match to the unknown substance or the unknown continues to burn when the match is removed, the unknown substance is ignitable.

Ignitable liquids are classified as flammable or combustible. Combustible liquids take longer to ignite than flammables. Flammables will ignite quickly and continue to burn. The match must be held to a combustible to ignite and may require constant heat to continue to burn.

### Method No. 2

Flammability testing is performed using a closed cup Seta flash unit at a specified temperature (60 degrees Celsius, 140 degrees Fahrenheit).

- Allow the cup of the flash unit to reach 60 degrees Celsius (140 degrees Fahrenheit). Turn on the gas, light, and adjust the pilot/test flame.
- Line the cup with aluminum foil. If the sample layer to be tested has a pH less than 2 or greater than 12, use Teflon tape to line the cup and note this on the Drum/Container Inventory Log.
- Place approximately 1 g or 1 ml of sample in the cup.
- Close and latch the lid of the cup and turn on the flash tester timer (one minute).

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- When the timer goes off, pull open the slide that controls the flame position and observe closely.
- If flash or pop sound is observed, then the flash test is positive. Record the result on the Drum/Container Inventory Log.

**NOTE: A FLASH MAY BE MORE EASILY OBSERVED IF THE WORK AREA LIGHTS ARE SHUT OFF.**

Samples having an extremely high pH or a very low pH can react with the aluminum foil, producing hydrogen gas and a false flash. If this situation occurs, use Teflon tape to line the flash cup.

#### Quality Assurance/Quality Control

At the start of each shift check the performance of the Seta flash unit with p-xylene and distilled water. Record the results on the back of the first Drum/Container Inventory Log of that shift. Always remember to date and initial QC checks. If you cannot obtain a positive test result with the p-xylene or a negative result with the distilled water, immediately notify the Project Chemist.

### **3.0 DATA REVIEW**

Once the field characterization testing is completed and before the bulk testing is performed, it is imperative that the data be reviewed and properly interpreted. Data interpretation is probably the most difficult and most important task facing the chemist performing the field characterization analyses. The procedure required to ensure proper interpretation of the data consists of the following steps:

After the sample passes the above review, then the field characterization data must be checked for accuracy and completeness and evaluated for chemical reactivity prior to classification of each layer. Multi-layered samples must be reviewed for inter-layer field characterization and to assign a field characterization group to the sample.

Prior to attempting to assign a field characterization classification to each layer, the data must be checked for accuracy. Transcription errors may have occurred and it is necessary for the data to be reviewed.

In every place where the data has been documented, it must be checked for transcription errors. If errors are found then they need to be corrected. If no errors are found then the data needs to be checked for completeness.

### **4.0 BULK TESTING**

Bulk testing is performed on samples which are to be combined, whether for generating a representative sample for disposal analysis, or for actually physically combining the waste containers in the field.

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Once all of the unknown substances have been field characterized and logged on individual records, bulk/compositing testing can be performed. This is accomplished by combining individual sample test classifications into one description for each sample (e.g., a water soluble, Beilstein positive liquid would be classified as a halogenated, inorganic liquid). This sample description will be a preliminary waste stream description. Be sure to indicate the characteristics of separate phases and/or layers of the sample. Multi-phased samples and single-phased samples represent separate waste streams. Mix equal amounts of all samples with the same waste stream classification, adding one sample at a time. If the addition of a given sample causes a reaction in the mixture, the sample is considered incompatible with the mixture and must be eliminated from this waste stream. The field characterization mixing must be restarted at the first sample once the incompatible sample has been eliminated.

## **5.0 COMPOSITING FOR DISPOSAL ANALYSIS**

All samples which are to be composited for disposal analysis must have been successfully bulk tested. It is imperative that backup data exists demonstrating that the samples mixed together are compatible. These samples are generally transported via overnight air. The waste containers themselves are transported over the road. Many disposal facilities will commingle the wastes profiled into their facilities in a bulk container. It is the responsibility of the Chemist to ensure that the materials within the waste stream are compatible. The safety of everyone who handles the samples and waste containers is at stake.

## 6.0 SHIPPING HAZARDOUS MATERIALS

When transporting testing kits, applicable regulations should be followed. When transporting over the road, DOT regulations take precedence. When shipping the kits through an overnight carrier, International Air and Transportation Association (IATA) regulations are to be followed.

The kits are comprised of a steel tool box and two UN-TH1 5-gallon pails. When transporting the kits, the hazardous materials should be packaged in the pails and the appropriate lids (NA2034) should be used. The following tables list segregation of the materials.

Pail #1	Quantity	Volume	Unit
Pyridine	1	15	ml
Chloramine T	2	1	grams
Hexane	1	250	Pail #1
Sodium Hydroxide	1	250	ml
Potassium Iodide	2	1.7	grams
Starch, soluble	2	3	grams
Sodium Phosphate	2	13	grams
Dichloromethane	1	250	ml
Sodium Cyanide	1	10	ml
Sodium Sulfide	1	0.02	grams
Cadmium Carbonate	2	2	grams

Pail #2	Quantity	Volume	Unit
Barbituric Acid	2	3	grams
Glacial Acetic Acid	2	40	ml
Hydrochloric Acid	2	40	ml
Buffer, pH 4.01	1	40	ml
Sulfuric Acid	2	40	ml
Sodium Acetate	2	4	grams

Extra space can be filled with expendable materials and equipment or can be shipped in the metal toolbox. Consult the most recent published IATA regulation listings and ship materials as "Chemical Kit," UN3316.